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STORAGE

REPORT OF OBSERVATIONS
OF
INJURIOUS INSECTS
AND
Biological
& Medical
Serials
COMMON FARM PESTS

DURING THE YEAR 1884,

WITH METHODS OF
PREVENTION AND REMEDY.

EIGHTH REPORT.

BY

ELEANOR A. ORMEROD, F.R. MET. Soc., &c.,

HON. CONSULTING ENTOMOLOGIST OF THE ROYAL AGRICULTURAL SOCIETY; HON. AND CORR.
MEM. OF ROYAL AG. AND HORT. SOC., S. AUSTRALIA, &c.

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PREFACE.

BEFORE submitting the observations of the past season to the contributors to whose kind assistance I am indebted for the information, I beg to offer my best thanks for their courteous co-operation, and to request its continuance. I wish also to offer my thanks for the assistance cordially rendered by the press.

It will be noticed that the observations have now been extended in some degree to insects affecting cattle and farm stock, and a slight corresponding alteration has been made in the title of the Report.

During the eight years in which our crop insects have been reported on, such full observation has been sent in of some of the regular yearly attacks that it seems to leave but little more to say with regard to these; but there are some points which are shown constantly and plainly still to want attention as the very starting-points of a large part of our yearly attacks, and one of these is treatment of grass and clover-lea before breaking up. Half or more of the ravages of the Wireworm and Daddy Long-legs grubs arise from these being in the land before the new crop is put in, and any notes of treatment to prevent egg-laying, or of applications or treatment to destroy the grubs in breaking up the land, would be very acceptable, as tending to lessen one great source of loss.

Warble Fly injury to our cattle, and Liver Fluke to our sheep, are two other important subjects. On the first I should be greatly obliged for any information and specimens; on the second, though I am not qualified to offer any advice relatively to the Fluke when in the liver of the sheep, yet as much might be done to lessen the amount of this disease by lessening the amount of the Marsh or Pond Snails, in which the Fluke spends the first part of its life, I should esteem it a favour to receive any

information on this head. Figures of Marsh Snail (*Limnæus*) and some observations on this subject are given at pp. 91, 92.

The amount of attention bestowed on the very important subject of insect prevention is showing year by year that the national losses are not by thousands, but by millions, of pounds. The loss in the Hop failure of 1882 was estimated at a million and three-quarters, that from Turnip Fly of 1881 at over half a million pounds sterling ; and a perusal of the losses recorded per acre as a regular yearly trouble will show what is going forward. The subject is steadily gaining the attention it deserves, but with this has come such an enormous increase of correspondence that I have made arrangements to enable me more especially to attend to all enquiries, and to communicate with those who may be disposed to note the effects of different treatment, and to report results. I shall feel it a pleasure to give my very best attention to all enquirers, and shall hope, if all be well, to be permitted again to offer the information given to my contributors.

The subject of bird-presence has lately been so much discussed that it seems desirable to add something more to the observations (pp. 5—11), which were in type when the discussion arose. Nobody wishes to destroy the small birds broadcast. We should suffer severely if their presence *generally* was lessened ; for instance, there appears to be good reason for considering that the insect-presence in 1879 was more than usual, owing in part to the destruction of birds by the cold of the preceding winter, and the cold wet spring affecting nesting and hatching (see Phenological Report of the Meteorological Society) ; but, on the other hand, if from special local cause, increase takes place to the great extent which is noted by Mr. Goodwin near Sevenoaks, this may need attention.

With regard to benefit received from many of our common birds, I think it may be of interest to repeat a portion of the information given at p. 38 of my Report for 1879, and to that list it is desirable to add Wagtails, as one or more species is stated to feed on the Marsh Snail, and consequently may help with regard to keeping down the Liver Fluke ; see above, in Preface, and also p. 91.

Among the species serviceable generally on forest trees, Apple trees, and fruit trees, the Report mentions the Titmice, including the Blue, Cole, Marsh, Long-tailed, and Great Tit (and of these

the Blue Tit may be specially observed at work among the Aphides on Gooseberry bushes); also the Warblers, Woodpeckers, Nuthatch, and Tree Creepers. The Lesser Spotted Woodpecker is noted as specially frequenting the Apple; the Golden-crested Regulus frequents the Scotch pines, Spruce, and other Coniferæ; the Bearded Tit, Yellow Wagtail, Titlark, Wren, Cuckoo, and Water Rail are mentioned as serviceable in Osier beds and reeds and marsh hay. Among the Gooseberry, Currant, and Raspberry bushes the Titmice and Warblers, the Wren, and the Cuckoo are noticed as of special use. Among Cabbage and Turnip crops the Partridge, Spotted Flycatcher, Swifts, Swallows, and Martins are serviceable. On grass, besides the Warblers, Swallows, Swifts, Martins, and Partridges before mentioned, the Wagtails, Pipits, and Starlings, are all of use. The Cuckoo is of special service from not refusing hairy larvæ, and the Flycatcher as destroying the White Butterflies.

But with regard to the one item of Sparrows, its special habits make this bird an exception to what we may fairly call our regular feathered *friends*, and in confirmation of the observations given in this Report, both as to their driving away other birds and their corn- and seed-feeding propensities, it may be well to draw attention to the observations of Mr. R. Lowe, of Sleaford, printed in my Report for 1883, including a year's observation of their food from examination of their contents and also of their habits, and likewise the opinion of Mr. J. A. Lintner, State Entomologist of New York State, U.S.A., who, while he presses the *importance of preserving insectivorous birds* in his First Report, p. 61, further mentions, amongst remedies for insect-presence, "levying a war of extermination on that unmitigated nuisance, the English Sparrow." To this bird Prof. J. A. Lintner ascribes the increase of various caterpillars, and it is not enough thought of with us (though it is very plainly to be seen) how much this audacious robber drives away the Martins, which, like it, frequent our homesteads, but which *are* exceedingly helpful in destroying over-amount of insects.

The following note is also well worth the attention of those concerned, which is contributed by Mr. A. Molineux, Member of the Committee of Agriculture of the Royal Agricultural and Horticultural Society of South Australia:—

"I have been writing lately on the Sparrow question, and also on the injury to Australian cultivators done by imported pests.

The Sparrows here have driven off nearly all our insectivorous birds, which of course are small, and have generally soft bills and a timid nature ; but the Sparrow will eat nothing but seeds, while seeds are available. When there are no seeds they will eat fruit,—when there are no seeds or fruit they will condescend to kitchen vegetables (or zonal pelargoniums) ; but if none of the foregoing are to be had, and the dog, the pig, and the cows cannot be robbed, the Sparrow will stay his hunger with Aphides or soft grubs and caterpillars.”

It is said (and rightly, if we could have it) that we should keep up the natural balance, but it is not possible in all cases to secure this. We are not in a *natural* but a *civilized* state, and, as civilization makes it necessary to destroy a large amount of birds of prey, and likewise to keep the idle lads of our country parishes from trespassing and killing all they come across at haphazard, it is needful that we should in some cases have a *counterbalance*,—a *legal* and *economie*, rather than a *natural*, balance.

There is no difficulty in doing what is requisite quietly and in due order, and relatively to this being done even in the fence months, so far as birds not included in the schedule of the Bird Protection Act, 1880, and Larks, are concerned, *without any infringement of the law*, or even the slightest expression of approval of illegal proceeding, I give the following reply, received by me from Mr. Gaskell:—“As regards the Act prohibiting the destruction of Wild Birds after the 1st of March, it appears that if an owner or occupier of land gives authority to persons to kill Sparrows or any wild bird not included in the schedule it is lawful and just, and we, the members of the Wirral Farmers’ Club, give that authority.”

I have not received from any quarter a single trustworthy observation of Sparrows *feeding* regularly on insects ; nobody doubts that they can and do *sometimes* take them, in special circumstances ; and it may be that, in the words of one of our well-known naturalists, “The Sparrow, like other creatures, adapts itself to circumstances, and in towns where it cannot procure grain it lives on a great variety of food, and destroys a great number of Aphides of various kinds and Cockchafers.”

These circumstances, however, are *exceptional*, and do not bear on our flocks and coveys of Sparrows demolishing the harvest ; the harm is before our eyes. I can bear witness to it

personally. What the extent is none know better those for whom this Report is especially written, and if they will give me any notes bearing on the subject in either way I shall be most happy to insert all information.

It would be very desirable to have reliable notes, showing amount of acreage attacked in autumn, loss per acre on the crop and amount of damage to stored crop, if appreciable, as to bean stacks, &c., and also whether attacks are increasing in amount yearly.

I beg, as in former years, to offer my thanks to Messrs. Blackie and Son, Glasgow, for the use of many figures. One figure is also retained of those originally lent for the Report by the Proprietors of the 'Gardeners' Chronicle,' and I have added various illustrations drawn from life.

ELEANOR A. ORMEROD,

*Hon. Consulting Entomologist of the Royal Agricultural
Society of England.*

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1885.

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NOTES OF OBSERVATIONS
OF
INJURIOUS INSECTS
AND
COMMON CROP PESTS
DURING 1884.

APPLE.

Winter Moth. *Cheimatobia brumata*, Steph.



CHEIMATOBIA BRUMATA.

Winter Moth. Male, winged; female, with abortive wings.

In the winter of 1883-84 experiment on a large scale was set on foot by Mr. W. Charman (gardener to J. G. Strachan, Esq., of Farm Hill Park, Stroud, Glos.), relatively to protection of fruit trees from the attacks of the very destructive caterpillars of the Winter Moth.

One of the common kinds of these so-called Winter Moths is figured above; but the one special point in which several of the kinds resemble each other, and by acting on which their attack may certainly and almost entirely be prevented, is the fact of the female moth having the wings so abortive that they are useless to fly with. Consequently (excepting from accidental circumstances) the females have to make their way to the branches or twigs, on which they lay their eggs, by crawling up the trunks of the trees.

It therefore seemed very likely that smearing the trunks of the trees which had been yearly infested, with some sticky composition, which would catch the moths and hold them fast on their upward journey, could not fail to be of use; and Mr. Charman accordingly began trying this plan in November, 1883, at the time when the female Winter Moths first come from their chrysalids in the ground beneath the infested trees.

On November 10th he mentioned that he had used Davidson's composition, and found it stuck fast everything that touched it, and he had already found a quantity of wingless female moths sticking in the composition at the base of the trees.

On December 11th Mr. Charman reported he had caught upwards of 500 of the females, and the attempt at progress up the trees was still going on. The method of application was to paint the stem round for the breadth of one or two feet with a band of Davidson's composition, and go round sometimes (in a morning or occasionally) and scrape off the moths which had been caught. As these moths lay a large number of eggs, the destruction of each female materially lessens the number of caterpillars.

The above first half of the experiment was noted in my Report for 1883, but its full success could not be seen until the following May or early summer, when the "looper" caterpillars from the winter eggs appear. These caterpillars had been noted as being in such numbers on the attacked trees for the previous two or three years that blossom and leaves had both been destroyed; but the above method of stopping the moths from getting at the boughs proved highly successful in preventing the mischief happening again.

Mr. Charman reported this year (1884) that, "with reference to the Winter Moth, the fruit trees treated with Davidson's composition *were free from attack*, with few exceptions. I found a few caterpillars on several trees, but not in sufficient numbers to cause any annoyance. I account for their presence from the fact of there being a belt of deciduous trees immediately outside the garden wall, which were badly infested with Winter Moths; and I think the moths may have been blown from these on to the fruit trees, and thus escaped the composition.

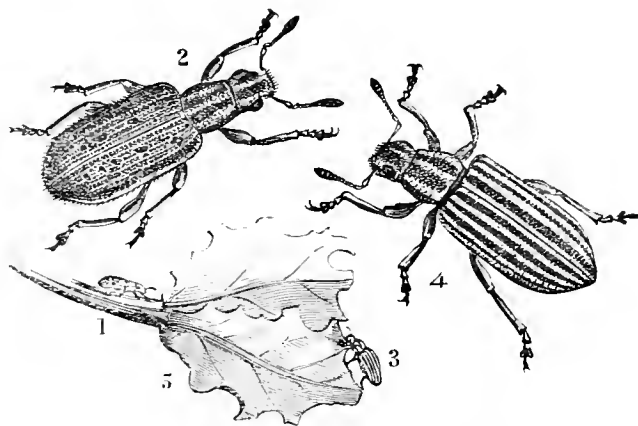
"I have again painted the stems of all the fruit trees previous to the 1st of November (date of letter Nov. 21st), and I have found a few moths attached to the composition. I may say I do not find the composition at all injurious to the trees."

The above method of treatment is well worth consideration to save attack in fruit orchards where the green "looper" caterpillars are at times (and not at all unfrequently) utterly destructive to the young leaves, blossoms, and all, in fact, that they can eat; and, as these

caterpillars attack deciduous forest trees also, it might in some cases be desirable to make the same application, either where there are some special reasons for saving the leafage of the trees, or where, as above, attack from the forest trees might spread to others. The female moths may possibly, as suggested, be blown by the wind from neighbouring trees, but it is also very likely that the winged male moth may, during the pairing time, be the means of transporting the wingless female from one tree to another.

BEANS.

Pea, Bean, and Clover Weevils. *Sitona lineata*, Linn. ;
S. puncticollis (and other species).



SITONA CRINITA AND *S. LINEATA*.

1 and 2, *S. crinita* ; 3 and 4, *S. lineata* (nat. size and mag.) ; 5, leaf notched by weevils.

Notes have been given in previous Reports of the habits of these destructive beetles, commonly known as Pea and Bean Weevils, though the mischief done by them to Clover is fully as great as to the other crops.

In 1882 and 1883 the life-history of the *S. lineata* in Peas and that of the *S. puncticollis* in Clover, which were previously unknown, were respectively given by Mr. T. H. Hart and Mr. R. W. Christy, and the severe injury to the crop roots by means of the small, white, legless maggots, as well as that to the leafage by the gnawing of the beetles above ground, was thoroughly shown.

Various means of lessening the damage were given in accompanying and previous Reports, though much more information is wanted, especially notes of *autumn treatment of stubbles* to prevent the weevils, which are frequently to be found in hordes and legions on the reapers, in the Pea waggons, &c., at harvest time, and which appear to have excellent

use of their wings, establishing new attack. This takes place partly by some of the weevils going down stubble-stems for the winter, partly by others laying eggs which produce the "white maggots" presently found causing damage at roots of Clover.

Mr. D. Turvill, of West Worldham, notes:—"I have to make a grave charge against the Pea Weevil. It does immense damage to young *Trifolium* plants, clearing them off completely in a day or two. Like the Turnip Fly, its wings render it a lively and difficult enemy to subdue."

The only other notes sent in this year relate to the presence of Starlings on infested crops; also the following observation, sent by Mr. Goodwin, of Winfield House, near Sevenoaks, which gives a convenient method of lessening amount of attack on Broad Beans in garden growth, and again draws attention to the importance of hearty growth in carrying plants through temporary attack.

Mr. Goodwin notes that in many gardens these weevils almost destroy the crop if their habits are not understood, especially if the weather at the time is against the rapid growth of the Bean:—"The harm the beetle does is by continually nibbling the edges of the leaf [see figure], thus seriously checking the plant. As many as six may be found on one plant, and they begin operations *almost as soon as the Beans are above ground*. They are most active in still sunny weather, and, if you approach at all incautiously, immediately drop perpendicularly to the ground, and lie still, as if dead, till the danger is past. Nothing applied to them or the plant is of any use, as the weevils are very hard.

"The only way I can keep them under in gardens is to lay the hand flat, and, separating two of the fingers, let the stalk of the Broad Bean pass between them. This, if done very quietly, will cause some of them to drop, and, the hand being extended, will catch those that fall, whilst the other hand picks them out of the turned-back edges of the leaves, where they drop or creep on being disturbed."

With regard to the appearance of Starlings in large numbers in insect-infested Pea-fields, Mr. Hart, writing from Park Farm, Kingsnorth, Kent, observed that the weevil began to commit serious damage, and, although the Peas grew away from this attack, Aphis followed, and "Starlings by hundreds frequented the Pea-fields, as also did numerous kinds of smaller insectivorous birds, *but not the Sparrow, until the Pea was large enough for him to peek it out of the pod.*"

Col. C. Russell, writing from Stubbers, Romford, in July, mentioned, "Starlings frequent fields of Green Peas in flocks": the neighbour, on whose ground they were then observed, failed to

shoot a Starling for examination, but large quantities of weevils (of which specimens were sent) were found in the waggon which carried the Peas, and it was thought the Starlings were after these beetles.

These flights of Starlings appear to be good examples of the kind of bird-presence that is useful. The insects come in great numbers, and the birds come from all about for a short time, presumably to feed on them, for if they fed on the Peas the ravage would be very plain to be seen. When the attraction is gone, so also will the concourse of Starlings go also; and whilst it appears to me that on the one hand there is no occasion to encourage them by artificial protection so as to injure reed-beds, or do other damage by their numbers, on the other hand it would be highly undesirable to destroy them or frighten them away.

BEET.

(See MANGOLD.)

BIRDS.

DEPREDATIONS OF SPARROWS.

The subject of the great loss caused by Sparrows still needs to be brought forward. The injury continues to be widespread and serious, not only with regard to corn, but likewise in fruit farming districts, and to garden crops; and to encourage those who are suffering under it to bestir themselves actively in getting rid of the pest, it is desirable to draw attention to some points connected with it which deserve consideration, such as what the food of the Sparrow is during the whole year besides the corn which we see it robbing us of; what its habits are; and likewise whether, where Sparrows have been destroyed during a series of years in any given area, that area has been infested *with more insects, or with more of any special kind of insect*, than when the Sparrows were there.

In this matter we refer (with one exception) to the House Sparrow, the *Passer domesticus*, and do not in any way mix with the subject considerations of other "small birds."

During the past season I have received communications from observers, of which I give a few to show that in counties far apart from each other the mischief is still continuing both to food-producing crops and likewise to the produce itself. I have also received communications regarding food found in the Sparrows' crops or gizzards,

but it does not appear to me with regard to this point that a few observations taken here and there, or even for several months at a time, can give a safe basis to rest on. Therefore (by his courteous permission) I have placed myself in communication with Lieut.-Col. Russell, J.P., D.L., of Stubbers, near Romford, whose thorough investigations during a long course of years into the habits of this bird enable him to furnish us with the details that we want.

Col. Russell gave evidence some ten years ago to a Committee of the House of Commons relatively to this bird. He has since then continued his observations, and, from the various documents which he has been good enough to place in my hands, I give (at pp. 7-9) some portions showing the results of his examinations, and also of his observations and experiments for upwards of twelve years. These, it will be seen, give not only his personal observations, but also bring forward many points—open to all to judge of—by which agriculturists and other sufferers may *prove for themselves* the *inaccuracy* of the arguments often used by those who urge the protection and preservation of these legions of devourers.

Firstly, however, with regard to a few of the observations sent in during this season, the Hon. Cecil Parker, writing from the Eaton Estate Office, Eccleston, Cheshire, on July 19th, remarked:—"The Sparrows are doing an enormous amount of damage. One of our tenants informed me that they began at his wheat before it was out of bloom, and, not content with that growing on the headland, they were attacking that growing in the middle of the field. They are also doing a considerable amount of damage to our wheat."

Mr. Reginald Christy, Boynton Hall, near Chelmsford, who is well qualified to form an opinion on the subject of bird-injury to crops, writes me:—"I can heartily endorse the views of Mr. R. Lowe* with regard to Sparrows, so much so that, all other remedies having failed, I am obliged to poison them. I have examined the contents of a great many at different times, and have invariably found corn and no insects."

The following communication is from Mr. T. H. Hart, of Park Farm, near Kingsnorth, Kent:—

"In my opinion the Sparrow is most decidedly our enemy. He begins in the spring by eating the tender heads of my Peas as they appear above the surface, then extends his depredations to my beds of Radish, Lettuce, Cabbage, and similar seeds. Next the early Peapods are robbed of their contents. Later on he turns his attention to Currants, Gooseberries, Raspberries, Cherries, Plums, and even sweet early Apples. During nesting-time a caterpillar is occasionally given

* Report for 1883, p. 41, depredations of Sparrows as shown by examination of their contents.

to the young ones, but is, in my opinion, by no means a staple article of diet. If it were so the *great numbers of Sparrows often seen about farm-buildings would soon strip the garden fruit trees and farm crops of the superabundance of insects*; but the fact that crops are repeatedly destroyed by insects in one state or another where Sparrows abound is sufficient proof to me that they are not our friends. As soon as the grains of corn begin to swell and become milky, the Sparrows flock to the fields and commit such havoc as alone is enough to make the farmer demand their extermination. It is not what they eat so much as what they destroy that is so annoying.

“I took measures last spring to reduce their numbers about my farm, and I think with very beneficial results.”

Mr. W. J. Goodwin, writing from Crouch, near Sevenoaks, expresses satisfaction at the bird question being opened, as it has been stated that the numbers of small birds are decreasing, whereas the numbers are alarmingly on the increase; and in the parish of Mere-worth and others some acres of Currants and Gooseberries have had to be grubbed up solely in consequence of Sparrows, Linnets, and Chaffinches plucking out the buds and the insides of the blossoms. “Boys and men have to be employed with guns and rattles to get any fruit produced at all. I can refer you to a dozen of the largest fruit growers in Kent in support of the statement.

“It is thought to be principally occasioned by the birds being too dense, and thus not getting enough of their usual food.”

The destruction of buds by small birds is often stated to be with a view of getting at small caterpillars or grubs within, which it is also stated (in a general way) would have destroyed the buds even if the bird had not taken them. On this point there may be a good deal of doubt, and I can say from my own experiment that, having had my Gooseberry bushes greatly injured, especially in 1883, by the buds being taken, that this year (that is in the spring of 1884) I had them well covered with lines of white wool. In consequence of this the birds let the buds alone, and a magnificent crop of Gooseberries and good foliage on the bushes followed.

The following observations by Col. Russell convey so much plain information, together with sound reasoning that all may prove for themselves, that I give extracts at some length as meeting many of our difficulties, and placing the subject in a clear light*:—

“The question whether Sparrows are useful to the farmer is easily decided; they *never go far* from houses and roads into the fields except at certain times of the year for the sole purpose of eating the corn, as may be proved by examining the contents of their crops.

* The extracts were taken mainly from a paper read by Col. Russell before the Essex Field Club in 1882.

“If they did any good to the farmer at all the land near their haunts would be worth more to cultivate than the enormously greater extent of ground, where they never take an insect. But this is not the case; the well-known ravages they commit on the grain, especially when it begins to form in the ear, are the only noticeable effects produced by Sparrows near villages, houses, and roads.

“Sparrows also do much mischief in gardens by feeding off young Peas, Lettuces, &c., eating Green Peas from the pod, *stripping Gooseberry bushes of their fruit-buds.*

“The question remains whether they do good enough in gardens to make up for such misdeeds there.

“For some years I carefully investigated the question of Sparrows’ food, examining that taken out of thousands, *old and young, killed at all sorts of times and places.* The general result was that the old ones contained *little else but corn, rarely an insect.* The young ones are fed with a great variety of food: corn, green and ripe, Green Peas, insects, &c. *At least 95 per cent. of a Sparrow’s food during its whole life seems to be corn.*”

Further, Col. Russell points out “that to prove Sparrows are really useful, it is not enough to show that *they destroy some insects*, but it must also be shown that *in their absence other birds would not destroy them as effectively.*”

This point appears to me very important, for it is often vaguely objected what mischief there would be if the Sparrows were not at hand, a confusion which seems to arise from quite disregarding that in the discussion we are not using the word “Sparrow” as a general term for all small birds, but simply for the one special and almost intolerable pest, the *Passer domesticus*.

Col. Russell continues:—“My object in letting no Sparrows live anywhere near my house has been partly to get a better practical test of their utility than any amount of examination of food in their crops. Sparrows having been *almost* absent from my place for years, *if* they took insects which other birds will not, such insects would increase, and the Sparrows killed there would show this. Now it has been quite as unusual to find an insect in an old Sparrow there as elsewhere.

“In fifty of all ages, from the time *they first feed themselves*, killed there one summer with food in their crops,—*this consisted of corn, milky, green, and ripe, and sometimes Green Peas,—only two small insects were found in the whole number.*

“With old ones, however, *eating few insects anywhere*, this was not test enough; but *if any insects were the peculiar prey of Sparrows*, and had increased, any *nestlings* there should be full of them. A pair or two of Sparrows have therefore generally been allowed to have a nest

in or near my garden, and nearly every year young ones have been taken there, and the food in them carefully examined with a lens. It varied greatly, but certainly *there were not* more insects, if as many, as where Sparrows abound. *Of caterpillars supposed to be kept down by Sparrows, only two small ones, and those in callow birds, have been found during the twelve years.*

“On the whole the deduction from these tests, so far as they go, seems to be that the insects given to their young by the Sparrows (they were allowed to live in numbers about my premises) would be so much food taken, when they most want it, from better birds which live entirely or nearly so, on insects, and thus (where not displaced by those ‘parasites on civilization,’ the Sparrows) keep down the insects more effectively than the latter.”

Col. Russell further mentions that after the almost total absence of Sparrows from his garden, “everything seems to do as well as elsewhere, many things better”; and he especially instances that the young Peas need no protection from birds, the Green Peas are not picked out of their shells, and the Gooseberry buds are not picked off.

The above observations appear to me to contain an enormous quantity of practical, valuable information; and the point of the Sparrows driving away Martins, which are certainly insect-eating birds, deserves consideration also.

If those who consider (as I certainly do) that the Sparrows should be diminished would look to the matter in good time, and clear out nests from *their own* outhouses, open stables, ivied walls, and the countless nooks which the Sparrows are so dexterous in finding out to multiply in, they might diminish the numbers wonderfully; and if they could *destroy the old birds at the same time I would advise them to do it*, without heed to the false sentiment which may stigmatise the act as barbarous.

No man or woman of proper feeling would willingly give pain to any living thing, but the lives of the lower animals have constantly to be sacrificed for our own support, and to allow the birds of the air, by ravaging the corn-fields, to carry off the daily bread we have worked so hard to grow is (to my thinking) contrary alike to all principles of religion and of common sense.

Another difficulty sometimes brought forward is that the Sparrows are supposed to be protected by the “Wild Birds Protection Act,” 1880, 43 and 44 Vict., in which (paragraph 2) it is enacted that “*the words ‘wild birds’ shall, for the purposes of this Act, be deemed to mean all wild birds.*”

This point, however, is met, for practical use, by the provision in paragraph 3, where, after specification of penalties for infringement of the Act, it is further stated, in the last sentence, as follows:—“This

section shall not apply to the owner or occupier of any land, or to any person authorised by the owner or occupier of any land, killing or taking any wild bird on such land *not included in the schedule* hereto annexed."

This, it will be noticed, permits all occupiers to destroy their Sparrows (*they not being* included in the Schedule of Birds and the amendment of the same, which I give annexed), and likewise throws no difficulty in authorising others—*i. e.*, telling the lads about the place—to clear them. The fenced times when this authority is necessary is "between the first day of March and the first day of August"; and therefore there is no restriction on destroying the autumn flocks by any means in our power.

With regard to most of our birds, they fill their place serviceably, and, unless from some cause there is an overwhelming increase in one locality, their presence is desirable. But, with regard to the Sparrows, *we see* the harm they do; and the long notes I have given on the authority of Col. Russell (than which I believe we can have no better evidence) show us that their absence was not followed by increase of insect-injury; and we know also the troubles that have followed on the introduction of the English Sparrow in Australia, in New Zealand, and in North America.

It appears to me that there is no doubt—1st, of the injury we are suffering; 2nd, that by a good watch for the nests we might greatly reduce the numbers; 3rd, that we are in no way hindered in doing this or lessening the number of our Sparrows in a regular and proper manner by the "Wild Birds Protection Act."

WILD BIRDS PROTECTION ACT 1880 (43 and 44 Vict.).

SCHEDULE.

American Quail	Fulmar	Merganser
Auk	Gannet	Murre
Avocet	Goatsucker	Night Hawk
Bee-eater	Godwit	Nightingale
Bittern	Goldfinch	Nightjar
Bonxie	Grebe	Oriole
Colin	Greenshank	Owl
Cornish Chough	Guillemot	Oxbird
Coulterneb	Gull (except Black-backed Gull)	Oystercatcher
Cuckoo	Hoopoe	Peewit
Curlew	Kingfisher	Petrel
Diver	Kittiwake	Phalarope
Dotterel	Lapwing	Plover
Dunbird	Loon	Ploverspage
Dunlin	Mallard	Pochard
Eider Duck	Marrot	Puffin
Fern Owl		Purre

Razorbill	Sheldrake	Teal
Redshank	Shoveller	Tern
Reeve or Ruff	Skua	Thick-knee
Roller	Smew	Tystey
Sanderling	Snipe	Whaup
Sandpiper	Solan Goose	Whimbrel
Scout	Spoonbill	Widgeon
Sealark	Stint	Wild Duck
Seamew	Stone Curlew	Willock
Sea Parrot	Stonehatch	Woodcock
Sea Swallow	Summer Snipe	Woodpecker
Shearwater	Tarrock	

By the "Act to explain the Wild Birds Protection Act," 1880 [August 22nd, 1881], the Lark is added to the above list of protected birds.

Whilst the above paper was in type, before printing off, I received the following communication from Mr. E. J. Gaskell, Secretary of the Wirrall Farmers' Club, Birkenhead, which conveys such solid information that I have much pleasure in inserting it. It will be noticed that the damage caused by Sparrows was estimated by the judges of the farm crops to be *one-third* in some districts, and the details given of the plan acted on for lessening the numbers of these terrible crop-pests may be a help and encouragement to work in other districts.

Mr. Gaskell, writing on December 13th, mentions:—"Some months ago you wrote asking for information respecting Sparrows so as to help with your Annual Report. I can now explain how I acted in our district. I sent a note to a suitable farmer, or other person interested in each township, asking them to act as paymaster, which they did, and for the summer months and autumn, till the end of September, we gave 3d. per dozen for old or young Sparrows or their eggs.

"We are now giving 6d. per dozen till the end of March. We had a settling-day on Tuesday last, and in most cases the paymaster had received subscriptions towards the expense from their neighbours, some handing me a balance over what they had paid, so that the Club was very little out of pocket; and we have had thousands killed, and hope to have a tremendous quantity killed this winter, it being the best time to get at them, as they are mostly about the homesteads and stacks at night.

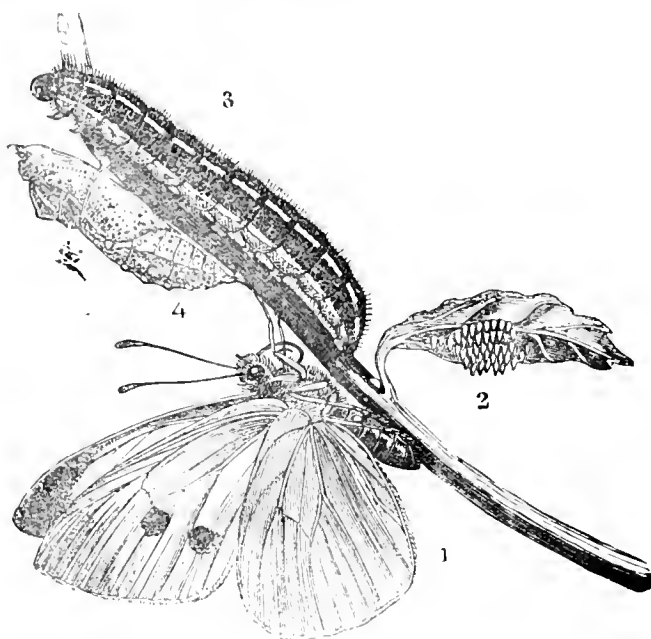
"We all think them very destructive, more so than any other birds, as they are more difficult to frighten, being so domesticated; and we think they can be well spared. The judges of our farm crops estimated the damage done by Sparrows to be one-third in some districts they judged crops in.

"If all Sparrows were killed, there are plenty of useful and harmless birds left to benefit us."

NOTE.—For further observations on Sparrows, and likewise on full attention to the requirements of the Bird-protection Acts being duly given, see Preface.—E. A. O.

CABBAGE.

Ichneumon Fly of Large Cabbage Butterfly. *Microgaster glomeratus*, Linn.



PIERIS BRASSICÆ.

1—4, Large White Cabbage Butterfly, eggs, caterpillar, and chrysalis.

In the course of October Mr. Ralph Lowe forwarded, from Sleaford, Lincolnshire, a number of clusters of the small yellow silken cocoons of the *Microgaster glomeratus*, the Parasite Ichneumon Fly of which the maggots feed within the caterpillars of the Large Cabbage Butterfly, and which were then to be found in unusually large numbers on some walls near Cabbage grounds in that neighbourhood.

These minute, somewhat wasp-shaped, flies are one of our best checks on the increase of the Large Cabbage Butterfly. The female Ichneumon inserts a large number of eggs, sometimes upwards of sixty, in one caterpillar, where they hatch, and within which they feed, avoiding the consumption of the parts necessary to the life of their host, which may often be picked out from uninfested caterpillars by its larger size, consequent on the number of maggots within it. When these are full-fed (which appears to be usually at the time their live host should have turned to the chrysalis state) the Ichneumon maggots make their way out of it, and spin small yellow silken cases about the eighth of an inch long, which are commonly found in clusters, like masses of minute silkworm cocoons, near the body of the Cabbage caterpillar, which has died from exhaustion instead of turning to chrysalis.

Ichneumon Flies (see Curtis's 'Farm Insects') have been seen coming out in May from cocoons spun in the previous September.

These little flies are only about the twelfth of an inch long, and hardly a quarter of an inch in the spread of their wings. The colour mainly black, legs bright ochre varied with black and brown, and the four wings transparent and iridescent.*

The attack reported by Mr. Lowe from Sleaford appears to have been partial, for on October 14th it was noticed that in many plots and gardens where Cauliflower and Broccoli leaves had been eaten to skeletons by Cabbage caterpillars no signs of the parasites were to be found; and at the same date the infested caterpillars, regarding which I was in correspondence, were reported to be continuing their migration, seeking for suitable winter quarters in which to change to chrysalids. Many had gone up buildings, leaving parasite cocoons at intervals on the walls, and some also up a brick wall ten feet high, leaving parasites on the inner side. Of these Mr. Lowe sent me fine clusters, with destroyed caterpillars lying in the masses of cocoons.

When the Cabbage caterpillar is going to turn to chrysalis it leaves the food-plant and creeps to any dry and sheltered spot, as under rafters, or boards in sheds, or under eaves or coping-stones, &c., out of doors, and the quantity of cocoons of the parasitic maggots found on the walls would be those that had come out of the Cabbage caterpillars on their journey to find a spot which their tenants prevented them needing.

When cocoons are found in these large numbers they should *not* be destroyed, and, if necessary to sweep them down, it would be well to throw them aside safely in an open shed, where the flies might develop in spring and be of service in checking caterpillar-attack.

CARROT.

Carrot Aphis, or Green Fly. ? *Aphis papaveris*, Fab. ; ? *Aphis carota*, Koch.

On June 16th Mr. W. W. Glenny reported, from Barking, Essex :—
“The Green Fly is doing grievous damage among the Carrots; the leaves are curled and look unthrifty. It is doubtful whether, even

* The accompanying figure of *Hemiteles melanarius* (magnified, with lines showing natural size) represents another kind of Ichneumon Fly, which preys similarly on the chrysalids of the Green-veined Cabbage Butterfly. It differs in some respects from the *Microgaster*, which has the “ovipositor concealed beneath the abdomen,” but gives a general idea of the appearance of an Ichneumon Fly.



with genial showers, the plant will rally from the attack of the numerous parasites.*

“My first impression was to plough up the plot of about two acres. My salesman advised patience, and to hoe the piece again. After an interval of ten days the improvement is not marked.

“Do we trace these and similar epidemics to the long prevalence of east wind in the spring? The growth of the plants is checked, and the insects apparently redouble their efforts, and stifle the crop in its infancy.”

This remark of Mr. Glenny's is well worth attention, for it gives, as a practical and field observation, the important point of checked sap acting in hastening Aphis-development, which Mr. G. Buckton drew attention to scientifically and experimentally some years ago.

I give the passages at length :—

“The addition of wings to the viviparous females obviously must much facilitate the spread of each species. This modification of form does not occur at fixed or stated intervals, but appears to be in some measure induced by an overcrowded state of the colony, and with a deficiency of food. Gardeners are well aware of the sickly and poisoned conditions produced in those plants which are subjected to the exhausting and irritating attacks of Aphides. When the nutritive juices of the infested plants begin to fail a change commences in the larvæ of those Aphides which are subsequently born. Swellings occur on the sides of the meso- and meta-thorax, within which the wings of the future imago are developed. . . . I have repeatedly observed the effect of stinted food in hastening the development of wings, whilst keeping the larvæ in confinement under bell-glasses.

“Some naturalists have thought that the often sudden appearance of swarms of winged *Aphides* in early spring may be caused by the action of the nipping easterly winds, which, by checking the flow of sap in the vegetation, remotely produces the same effect on the insects as the stinted food above noticed. To this atmospheric condition, which is usually accompanied by insect swarms and a peculiar haze, the popular voice gives the name of blight. Similar conditions of food and climate probably operate to produce the second large migratory flights of early autumn.”†

The above views, which seem to me very much borne out by what we constantly observe, namely, that the checked growth caused by bad attack of Aphides is favourable to their rapid increase, points to the special benefit of washes which may kill the Aphis as fly or louse on the leafage, and likewise, by falling round the plants, may

* “Lettuces are also suffering from the same enemies, and they are difficult to clean, and consequently unsaleable.”

† ‘Brit. Aphides,’ by G. B. Buckton, F.R.S., vol. i., pp. 72, 73.

act to some extent as a stimulating watering in driving on growth heartily.

Soft-soap is the best material that we know for the foundation of an Aphis-wash, as it acts as a fertiliser at the roots, besides being an insecticide. For this purpose it is (as has been mentioned before) particularly useful by reason of it adhering to the insects, from which mere watery washes, unmixed with sticky material, slip off without necessarily injuring them, unless they are in clusters where the wash can lodge.

The soap-wash can be used as a method of applying any insect poison thought desirable,—quassia, for instance,—or, with due care, it is very likely that the mixtures of paraffin mentioned under “Mangold-leaf Maggot” (and referred to in the Index under the heads of “Emulsion,” “Paraffin,” and Wash), might be of much service.

The great difficulty is how to apply the wash or watering to the root-cultivation at a paying rate on the broad scale of field labour. But, so far as an acre or two of land goes, where water is at hand or can be carted from neighbouring supply, if on experiment it was found the mixture was useful, the expense of applying the wash by hand-power from watering-cans would be a far less loss than that of the crop.

CELERY.

For detailed account of severe attack of caterpillars of *Agrotis segetum*, commonly known as the Dart Moth or Turnip Moth, in a Celery ground, see paper on Turnip Moth and references in Index.

CORN AND GRASS.

Antler Moth, or Grass Moth. *Charcas graminis*, Stephens;
Cerapteryx graminis, Curtis.

On the 18th of June Col. Picton Turbervill, of Eweny Priory, Bridgend, Glamorganshire, wrote :—“ I forward you a local paper with an account of the appearance of caterpillars in large numbers in the mineral district of this county.

“ In Bridgend to-day a tradesman, Mr. W. Williams, told me there were vast numbers on a farm on the hills not far distant, and (as I am

going abroad in two or three days) I asked him to procure some and send them to you."

Specimens were forwarded directly after, which agreed so precisely with caterpillars of the Antler Moth, *Charæas graminis*, which were forwarded to me in 1881, when there was a somewhat similar outburst of this kind of caterpillar at Clitheroe, in Lancashire, that I consider the Glamorganshire attack was also caused by this kind, although, looking at the great extent of country over which the ravages of the caterpillars extended, it is impossible to say whether other kinds may not have been present also.



CHARÆAS GRAMINIS.

Antler Moth and caterpillars.

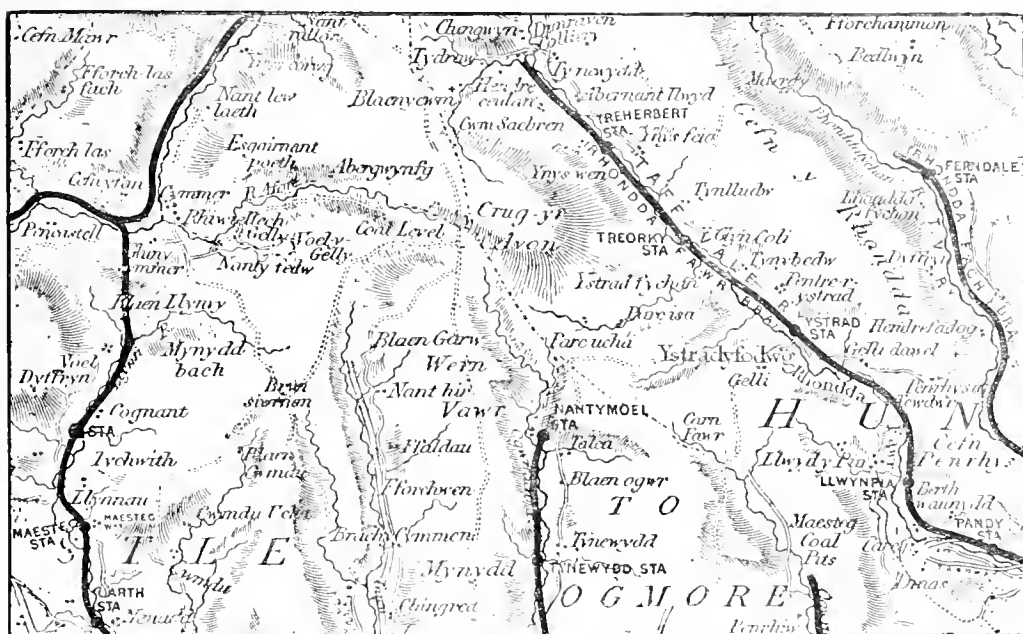
The above figure gives the size and method of marking of the Antler Moth and caterpillar. With regard to colour, the moths are variable, but may be generally described as having the fore wings of various tints of brown, with somewhat pale or white antler-shaped markings, from which the moth takes its name. The hind wings are brown or greyish brown.

The caterpillars are marked with dark brown and pale streaks running lengthwise; the head is brown or yellowish. The life-history is stated to be that the eggs are laid by the female moths about the middle of the summer; these hatch in about three weeks, and the caterpillars are then said to hide themselves by day and feed by night they live through the winter, and in spring again begin their destructive operations. These continue till about June, when they go down into the ground to turn to chrysalids, from which the moths come out to lay the eggs, as above mentioned, in July and August.

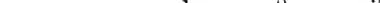
To those unacquainted with the habits of this kind of caterpillar, the enormous numbers in which they sometimes swarm over large tracts appear as alarming as they are unaccountable; but this great visitation in S. Wales does not differ in any point excepting the very large area attacked from various appearances recorded before in this country, as, for instance, the one which will be remembered as occurring at Clitheroe, Lancashire, in 1881, and a great appearance on Skiddaw about 1824, also on the Hartz Mountains of Germany in 1816 and 1817; and the devastating power is the same which made

Linnæus describe this grass pest as “the most destructive of Swedish caterpillars, laying waste our meadows, and annihilating our crops of hay.”

The localities usually attacked are grass in mountainous districts, and the accompanying map will show the mountain ground and large area over which last summer's attack extended in Glamorganshire.



District of Glamorganshire attacked by caterpillars of Antler Moth (Photo etched from Cruchley's Tourist's Map).

Scale of English miles. 

The north-east side of the Rhondda Valley, which is the most easterly limit named, lies some ten or twelve miles N.N.E. of Bridgend, and it will be observed from the following account that the attack extended thence westward past the Ogmore Valley and the Garw River to Maesteg, the most westerly limit named, and that the large extent over which the smoke of the mountain fires was seen showed the caterpillar-presence spread widely on a scale requiring strong measures to check it. Altogether the area of the attack taking the diameter from W. to E. does not appear to have been less than ten miles.

The account forwarded to me on the 18th of June mentioned that on the mountains of Ystrath-y-Fodwg (hills about ten miles north of Bridgend, in Glamorganshire) myriads of caterpillars were devouring every green thing, leaving the mountains brown behind them.

It seems they were first noticed on Bwlch-y-Clawdd, a lofty ridge separating Cwm Park from the Rhondda Valley; but on Sunday (the 15th of June) it was found that they had attacked, or rather were attacking, also the north-east as well as the west side of the valley. At Treorky Station (a station on the Rhondda branch of the Cardiff

and Merthyr Railway) the mountain brook running from the Fforch Mountains was thick with myriads of these caterpillars, which had been drowned by falling into it during their march across the side of the mountains. The Ystrad side of the Bwlch-y-Clawdd Mountains above Cwm Park were "brown, as the result of recent fires ignited with a view to destroy the pests." Near the summit the insects were observed, which moved down to the mountain-path from the burnt herbage with extraordinary rapidity. Some of them were secured, and (as above mentioned) specimens from the hordes were sent to myself for examination.

On proceeding some miles towards Maisteg, leaving the Ogmore and Garw Valleys on the left, everywhere caterpillars were swarming, and a large hole in the peat was observed in which thousands of the caterpillars had fallen and died. The Maindy and Bwllfa Mountains were alive with them, and, standing on the ridge above the Ogmore Valley, the smoke of the mountain fires was to be seen to the west, where attempts were being made to destroy the pests.

Further details are given in this and in other accounts, of which the main points are—the great area attacked and the damage done; the necessity of burning the surface to destroy or drive away the caterpillars, and likewise the vast numbers found drowned where there was water to fall into; and also the quantities of rooks or crows which flocked to the infested area.

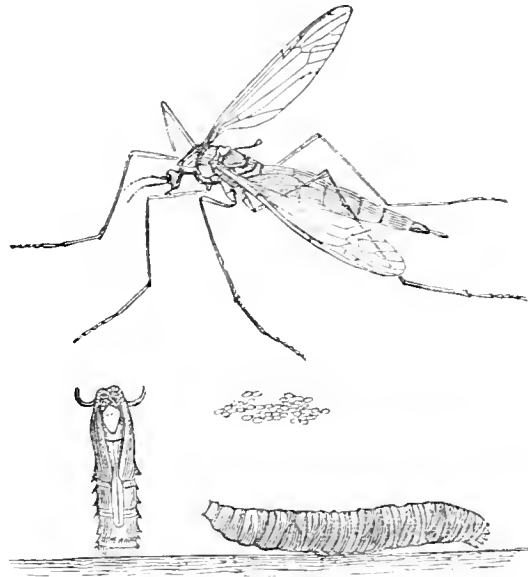
All these points coincide with what has been reported of similar attacks elsewhere, but, as I am not aware of the geographical area of an attack ever having been so minutely recorded, I have thought it desirable to give it at length, with a map accompanying.

The only available remedy for attack on this vast scale appears to be the one made use of, namely, firing the surface, and thus getting rid of great numbers of the caterpillars amongst the burning grass and heath, and other mountain plants which would help to feed the fire.

The habit of the caterpillars of going right onwards, whether into streams, standing water, or otherwise, together with their activity in crawling in bodies away from the fired ground, might very possibly be utilised to direct the course of some of the hordes into a stream or other convenient end.

On a moderate scale of attack it has been found to answer to turn pigs on the infested land, or plough the surface to turn the grass roots up with the caterpillars amongst them for the pigs to clear.

Daddy Longlegs. *Tipula oleracea*, Linn. (and other species).



TIPULA OLERACEA.

Daddy Longlegs, eggs, grub, and chrysalis.

1884 has been marked by severe attack of grubs of the Daddy Longlegs. The large number of the flies which had been noticeable in many localities in the previous autumn gave sign of what was to be expected, and the steady course in which the attack came on is worth notice, as this is one of the kinds of attack in which (unless measures are taken to obviate it) the presence of the injurious insect may be pretty surely foretold.

With such of our crop insects as hibernate—that is, pass the winter in a torpid condition—a mild or variable winter may be rather a means of destroying them than otherwise, for the warmth brings them out from their shelters, as we see with Turnip Fly on a sunny day in late winter, and many are taken by birds or nipped by the return of night frosts before they can shelter again; but it is different with those that live (and feed, weather permitting) below the surface.

The mild weather keeps both the plant and ground in a condition which suits them, and, though we cannot say that the cold kills them, as the Daddy Longlegs grubs will stand being frozen without hurt, still, for the time being, frost “firms” the surface as effectually as the roller, and with such grubs as go down deep in frost, and do not come up again *directly* it is gone from the surface, the crop gets a little respite.

Last winter (1883–84) it will be seen from the observations that the grubs were advanced enough in growth to sweep off autumn-sown wheat in December, and they continued actively at work through the winter; damage continued to be reported through the season, until in

autumn, specimens of the chrysalids sent in showed that the autumn flight of the Daddy Longlegs Flies was soon coming to set up attack for 1885.

As usual some of the worst attack was on crops after broken-up Grass or Clover ; it was also reported from the peaty soil of the Lincolnshire Carrs, and from low-lying land near a river, about three feet above the water-level. The grubs were found in injurious numbers in rotting turf, also sheltered beneath turfs and under clods, which gives a hint where to search for them in hand-picking, besides directly amongst the crop.

Amongst direct remedies noted hand-picking was found serviceable, likewise hoeing, which was noticed to cut through many of the grubs ; but rolling did not answer with any certainty. Amongst the applications to help the crop over attack, *nitrate of soda appears to have answered much the best*, and the careful experiments of Mr. Ralph Lowe show that this chemical has an immediately injurious effect on the grub, besides having the good fertilising effect on the crop, which we are aware of. The *non-effect* of other chemicals, and the amount of weight bearable by the grub, shown by Mr. Lowe's experiment, are also serviceable practically.

One of the earliest notes of the season was sent from Westleigh, near Bideford, Devon, on the 8th of February, by Mr. Edward Berry Torr, as follows :—

“I am sending you, by this post, a few grubs collected from a seven-acre field, which they have attacked and destroyed twice. The field was in wheat in 1880, and seeded down with grass ; it was fed with sheep and horses in 1881, and the same in 1882 ; and ploughed ‘ley’ for wheat on October 9th and 10th, 1883. It was then well harrowed, and sowed with wheat on November 14th. The seed came up nicely, it having been pickled with Down's ‘Farmer's Friend’ and tar to prevent the birds attacking it. It had not been long above ground before it was noticed as looking sickly, and in a short time it ceased to exist. We then searched, and found these grubs underneath the remaining blades of wheat. Thinking they might not attack a second sowing we harrowed over the field on January 3rd, and left it for a few days for the Rooks to eat up these grubs. They went to the field, but soon left it ; and on January 7th and 9th the field was resown with wheat of another sort, but pickled, as before described. I went to the field on the 28th, and could see but few blades of wheat above the surface, and I made but a slight inspection, but found a few grubs.

“On the 4th inst. (February) I again inspected the field, and then found plenty of the enclosed grubs, and also a few grains of wheat partially eaten by them. To-day I have sent my foreman, who,

after much difficulty, has found the wheat sent herewith, but had no trouble to find *hundreds* of the grubs.

“Later on the field was ploughed in the middle of March, and worked down and sown with Barley on April 15th, and was *manured with 1 cwt. of nitrate of soda as soon as well above ground, and the result was entirely satisfactory.*”

On the 21st of May Mr. Thomas Read reported, from New Barn Farm, Keynsham, the loss he was sustaining from the destruction of his Barley plants by a grub (Daddy Longlegs from specimens forwarded) which attacked the plant when putting out the second blade, and continued its ravages up to the date of writing, clearing the plant as it traversed the field about half an inch beneath the surface of the soil.

Mr. Read noted that, the soil being very stony, he could not use the harrow, or should destroy the plant. “*An exceptionally heavy roller had been used without the slightest effect on the grub.*”

Shortly after more specimens were forwarded, apparently full grown, with the mention that they did not then appear to be spreading so fast in the field; likewise that, before writing the previous letter, the field had been given *a heavy top dressing of nitrate of soda.*

On the 15th of April Mr. J. B. Scott, of Sutterton, near Spalding, wrote regarding the same pest:—“Since last autumn I have suffered from a plague of black grubs. The first field I noticed was wheat sown October 17th *after grazed seeds* down one year.

“I saw the wheat came up slowly, and appeared to be eaten off by something. I dug in the drills, and found the land to be swarming with little grubs, which have since grown much plumper and longer. I sowed in December two tons of soot in the worst part of the field, but it failed to kill them, though the wheat that is left looks a darker colour for it.

“I have since Cambridge rolled and harrowed it, and sown two tons of salt and half a ton of nitrate of soda on about twelve acres of land, but the grubs still survive, though I believe their ranks are considerably thinned.

“In spite of the wheat improving a little I have had to patch up with April wheat two or three acres of the thinnest places.

“I fancy that *my top dressing will cost me as much as the crop will be worth at present low prices.*

“My wheat after Beans was also partly destroyed by the same grub.

“I have also a field of Oats, sown *after two years grazed seeds*, looking thin in the low places, and I find the grub is the destructive agent. I drilled artificial manure to help it out of the way of the grub.

“This grub has caused me great disappointment and loss, as my corn went in fairly well and was not damaged by wet.

"The soil is, part of it a heavy loam, but silty on the high portions of fields.

"For the future I shall, if I can spare the feed, *plough up Clover leys just before harvest*, and work them about.

"I should think that if the leys could be broken up, say early in August, it might prevent the Daddy Longlegs depositing its eggs, as I did not notice the grass-lands swarming with the flies till the latter end of August and September."

On the 10th of May Mr. Scott wrote further :—"My wheat has improved in colour, but is still thinned by the grubs.

"I have just hand- and horse-hoed it, which has disturbed it, *and cut a many in pieces*. I have a few Spanish fowls near the field, and I notice that they pick up some food after the hoers, and think it may be the grub.

"Some six or eight weeks ago I saw large flocks of Starlings on the field plagued with the grub, but have not noticed any on very recently."

On the 24th of May the Oats, after two years' seeds, were just finished being hand-hoed, and, owing to the land setting hard, and the sods making it hoe badly, it cost 5s. 4d. per acre.

Boys were employed to pick up grubs for two days in the low parts of fields, where they were most abundant, and picked up about eight pints. Some grubs were still to be found, but *since the weather had been dry and cool* the grub was not quite so near the surface.

From the above observations it will be seen the grub was destructive, and necessitating expense to keep it down from December to the end of May; and the result Mr. Scott noted on Oct. 20th as follows :—

"The grub continued to work at my Wheat and Oats till about the beginning of June. I have just thrashed a portion of the grub-worked wheat-field, which has yielded at the rate of $4\frac{1}{2}$ qrs. to the acre, but I had to patch up with April wheat. The crop was the heaviest where I had sown soot at the rate of 5 or 6 cwt. per acre. Owing to the low price of wheat I do not suppose it will pay for the top-dressings and hand labour."

With regard to prevalence of grub-attack in the neighbourhood of Spalding, Mr. Scott reported that a farmer at Kirton, about five miles off, had a fourteen-acre field of Oats, and likewise his Beans, quite destroyed by this pest, and many farmers suffered more or less in that part of Lincolnshire, where the land is heavy.

The following notes refer to attack on the *peaty soil* near Mansfield, Nottinghamshire, and to the presence of "grub" in *wet land*; likewise to grubs being found in *rotten turf*; and to turfs and clods being favourite sheltering places in fields.

On May 15th Mr. Fred. Turner, writing from Mansfield Woodhouse,

Mansfield, forwarded me a box of Daddy Longlegs of the blackest slate-colour I ever saw, with the mention that they were infesting a particular part of the Duke of Portland's property near Gringley, on what is known as the "Carrs." A quantity of the moist peaty earth in which they were found was put up with them, and the colour of the grubs was hardly distinguishable from that of the peat-soil. It was noted that "the havoc just now is very serious, and much anxiety is expressed as to the best means of getting rid of such a very dangerous pest to growing crops, which it devours *not by yards, but by acres.*"

On the 9th of May specimens of Daddy Longlegs grubs were forwarded by the Hon. C. Bouverie, with the mention that they were injuring various plants in the garden at Longford Castle, Salisbury. The ground was noted as made soil, partly on a river deposit, partly on clay, lying very low, water-level three feet below surface. As this kind of grub has a habit of collecting in parties under turfs lying on the surface of the ground, I suggested, amongst other things, placing damp turfs near the infested spots, and examining them from time to time and clearing away the grubs. Later in the year I was informed the plan had been tried, and proved partially successful.

On Sept. 3rd Mr. Bouverie forwarded more specimens of "grub," accompanied by chrysalids of the same, found together under turf in a low-lying situation near the River Avon.

From a communication received through the courtesy of the Editor of the 'Farmer's Gazette,' Dublin, I take a note that under one sod which had been brought to the surface by the harrow and then pressed down by the roller, so as still to retain a little moisture, no less than ninety-four grubs were counted.

On the 1st of May Mr. R. Laycock wrote with respect to "grubs" then attacking his Oats at Winlaton, Blaydon-on-Tyne, and forwarded specimens taken from under *clods of earth*. He observed :—"As anything I may put on the land to kill them seems hopeless, I think of trying to set people to collect them, and thus save part of a crop of Oats"; and later on he reported that the *hand-pickers had killed a large number*, and likewise the Rooks came and had a feast.

The following communication shows how rapidly heaped rotting turf is sometimes infested :—

On the 24th of March I received a packet of Daddy Longlegs grubs of various ages, up to being a third or half-grown, from Mr. J. Watson, Agent's Office, Shirburn, Tetsworth, with the mention that they were doing much harm to valuable plants in a propagating-frame, in which the soil was taken from a heap of old turf. The turf had been taken up about four inches deep at the end of October, and put in a heap. At the end of February some of it was sifted for use in the frame, and

the grubs appeared at the same time in the frame and in the remaining portion of the turf-heap. Hot lime applied in good quantity to some of the grubs, which were caught for experiment, killed them in about two minutes; but lime and soot applied to check attack (in small quantities) had no effect, and the attack was presently checked by *hand-picking in the evening*.

The point of whether the grub is *commonly* to be found on the surface of the ground between dusk and dawn is of considerable importance relatively to best time for rolling; but the observations seem to leave this matter where it was, namely, that the grubs sometimes come up, and sometimes stay below the surface at night.

Mr. Berry Torr favoured me by having special observation taken at Westleigh, near Bideford, when bad attack (as mentioned above) was going forward, and the grubs were found on the surface in large numbers at about 1 o'clock in the middle of the night. This was in February.

On the 10th of May, Mr. Scott wrote me, from Sutterton Grange, Spalding, relatively to search for Daddy Longlegs grubs above ground:—"I have looked for the grub at 8, 9, 10, and 11 p.m., but have not yet seen one above the surface of the ground. I found them an inch or so under the surface, the same depth as in the day."

The following notes give a few observations of the *presence or absence of birds on infested fields*, but it cannot be said that the labours of the Rooks were wholly satisfactory, neither that the operation of clearing off the grubs appears good for the domestic fowls.

The following note, sent on February 22nd by Mr. T. Wreford, from Clannaborough, Bow, N. Devon, refers to a great visit of Rooks accompanying great presence of "grub":—"A field of wheat tilled on the 9th of November was thick and rich-looking up to 2nd December. There were a few days of rather sharp frost about this time: the day the frost left the land I was surprised to find the field so gay-looking turned to a dead brown fallow. We have several rookeries around here, and in a few hours the birds had absolutely almost destroyed every plant in the field.

"My hind took at once the side of the Rooks, and we made a close examination of the soil. We took different parts of the field, and we found sixteen grubs in sixteen square inches. To resow the field is useless, as there is grub enough to destroy twenty crops."

Mr. T. Read, of New Barn Farm, Keynsham, reported, on the 21st of May, that the only birds that visited his grub-infested Barley in any quantity were the common Plover or Lapwing.

On the 7th of May Mr. Smith, of the Grove, Cropwell Butler, near Nottingham, forwarded specimens of the Daddy Longlegs grubs, with

the note :—" I send you specimens of the grub that has been and is destroying us acres of Beans.

" The field where the Beans are was Red Clover and Rye grass last year, and was ploughed up about the end of February. The Beans were drilled three bushels to the acre. We noticed that they were very thin in certain parts of the field, and there is one patch of about two acres with scarcely a Bean left.

" I remember no particular difference in soil or cultivation to account for the attack on this particular spot.

" The Beans have been destroyed in a less degree over most of the field. Some of the grubs are visible on the top of the ground, but if the soil is slightly scratched they are to be seen by the score on the square foot.

" A neighbour has had a fowl-hut taken into his field, and, a fowl dying, he opened it, and found it to contain several hundred grubs.

" I have not noticed any birds such as Rooks on our field. The soil is a fine loam on red clay subsoil."

*Experiments as to effects of Chemical applications and pressure on
Grub, &c.*

On the 1st of June Mr. Ralph Lowe, writing from Sleaford, Lincolnshire, reported that the enormous numbers of Daddy Longlegs observed in 1883 were producing the result to be expected. The larva had for some months made havoc with Wheat and Barley; at the date of writing many fields of Beans were suffering from its ravages; and in gardens the Scarlet Runners and Peas had been injured.

Details of attack are given on a field at Ewerby :—" A sixteen-acre piece of Clover had been manured with farmyard manure, half with manure made in 1882, laid on in March (1883); the field was mowed for fodder, and the eddish eaten with sheep. The other half of the field was then manured with *fresh-made manure*, ploughed once, and drilled with Barley.

Patches came up irregularly, and these patches became larger, and soon were quite bare; and it was found that great quantities of what were called 'Black-worms,' or Leather-skins [*i. e.*, Daddy Longlegs grubs, Ed.] were destroying the plant upon the part manured with the *old manure*.

The worst parts were harrowed, and rolled with heavy rollers repeatedly, getting a good tilth. It was drilled again with Barley, which fared nearly the same as before; the grubs ate the young shoot, and then the grain itself.

" I found great quantities of the larvæ of the Daddy Longlegs, some fully grown, others half that size, under the furrow, where they were quite secure from the effects of the heaviest roller."

From these Mr. Lowe selected a number for the following experiments, with a view of ascertaining whether the various applications were of service beyond stimulating the crop to a more rapid growth.

A few of the grubs were covered respectively with quicklime, soot, household salt, and superphosphate. These were secured, as they crawled away from the applications, for further investigation. Others were placed in earth mixed with one-fourth of white arsenic; and in twelve hours only those which had been in the arsenic appeared at all the worse, and even these recovered before the following day.*

Brine was tried at a strength of one pound of salt to a quart of water, and the grubs dropped *into* it died in a short time; those on which the brine was merely poured were none the worse.

Nitrate of soda, however, gave different results. The grubs that were placed in it were *apparently* dead in three hours.

“Mixing nitrate of soda with a considerable quantity of earth had the same effect; the grubs were *to all appearance* killed pretty quickly, both large and small ones.” Likewise, “A weak solution of nitrate of soda poured upon soil containing a large quantity of the grubs, likewise to all appearance killed the whole of them.”

Mr. Lowe observes:—“So far I think that where the larva of the Daddy Longlegs are suspected, it would certainly give good results (*for roots*) to mix nitrate of soda with farmyard manure, turning twice.

Later in the year Mr. Lowe went over his experiments again, and verified the point that salt, lime, soot, and superphosphate did not inconvenience them; but with regard to those treated with nitrate of soda, though they appeared to be dead, yet placed in damp soil they recovered, and in a few days were as vigorous as the others.

From this second experiment it is open to doubt whether the grubs which appeared dead after treatment were so or not; but, looking at Mr. Lowe’s note that those which recovered did so “after being placed in damp soil,” I certainly think that his experiment greatly confirms the value of nitrate of soda as a *direct deterrent* to the grub, as well as stimulant to the crop.

It is shown that the presence of this application, whether mixed with the soil or in solution as a watering, has a direct ill-effect on the grub (which I can confirm from having seen it void its contents when dropped into the nitrate); and here, I think, we may rest on three useful points. The nitrate is beneficial to the plant; it is also hurtful to the grub; and, even if it only makes the soil affected distasteful, we get benefit by driving the creatures partially away.

Further, Mr. Lowe, to try the effect in ordinary circumstances,

* Some of the grubs that had been covered respectively with salt, quicklime, and soot were placed in bottles with partially rotted leaves and sprouted grain, and were developed in due course to flies.

filled pots with earth, and, having placed grubs at a depth of within one inch of the surface, these pots were respectively covered with an amount of salt representing 1 ton per acre, lime 3 tons per acre, and nitrate of soda 2 cwt. per acre. These were watered with rain-water until the soil was well saturated, and "the effect in salt and lime was not perceptible. The grubs treated with the nitrate of soda were very relaxed, soft, and helpless—"will probably die"; and eight days after Mr. Lowe wrote that they still continued limp and helpless.

With regard to amount of weight that could be borne by these grubs, Mr. Lowe placed some of them in a box of moderately damp soil, about an inch from the surface, and applied a pressure of $2\frac{1}{2}$ cwt. for five minutes. The soil was pressed very close, and the grubs, on being *exposed to the air*, soon recovered.

Repeating the experiment for the same length of time—that is, five minutes—with the lesser weight of 2 cwt., but *leaving the grubs in the compressed soil*, it was found that forty-eight hours afterwards none of them had moved, and Mr. Lowe considered they would not have moved, but died where they had been pressed down.

The above experiments appear to me of much value in confirming or showing the method of action of two of the accepted methods of lessening the ravage of Daddy Longlegs grubs.

The following note refers to a case in which the presence of the grubs of one of the mud-feeding kinds of Daddy Longlegs in drinking-water drew attention to the course of the supply-pipes having by mischance been so altered as to convey the water after its passage through a cattle pond instead of direct from the cistern.

On the 28th of February Miss F. A. Gibbings wrote from Cranham, near Stroud, Gloucestershire :—"At present we are much troubled by large grubs in the drinking-water. I find the pipe that supplies us has communication with a pond to which the cattle have access. I enclose a specimen. They are most unpleasant creatures to discover, as we did three days since, in water poured out of the tea-kettle, and I may add *all in the house* have lately been ill."

On examination the grub proved to be the larva of a large kind of *Tipula*, but, what was of more importance, was the state of the water in which it was forwarded being so foul as quite to account for the continued illness of several members of the household.

I therefore telegraphed to the sender to stop any more of the water being used for drinking purposes, and likewise took on myself to report on the subject to the Health Officer of the district.

On investigation it appeared that the water-supply had originally been conveyed by pipes from a tank at same distance, and at some

time unknown a drinking-place had been made for cattle by forming a pool across the course of the pipes, taking up a portion of them, so that the water ran into the pool on one side pure and clean, and replacing them on the other, so that the water-supply went on again from the pool, in whatever state the water might have become there. The pool was noted as full of duckweed and green slime, and was open to defilement by cattle standing in it; and on inspection the Sanitary Officer stated that the water was injurious to the health of those drinking it. A list was sent to me of various water-insects which had floated down the pipe, and which came with the drinking-water on turning the tap. These included Dragon-fly grubs, also grubs of some of the large water-beetles, and other insects besides those I had seen.

The above observation is of service in turning attention to the need of looking, when unaccountable illness occurs, as to what may have happened where supply-pipes are open, even to possibility of being tampered with, and likewise to note that, though Marsh Daddy Long-legs grubs and others may do no harm beyond being exceedingly disgusting when appearing from a tea-kettle, yet that the foul mud that suits them, and the dirty weedy water that suits other larvæ, are sure parents of illness, and the presence of the grubs is a sure sign of *something amiss that should be looked to without loss of time.**

Corn Thrips. *Thrips cerealium*, Haliday; *T. physapus*, Kirby.

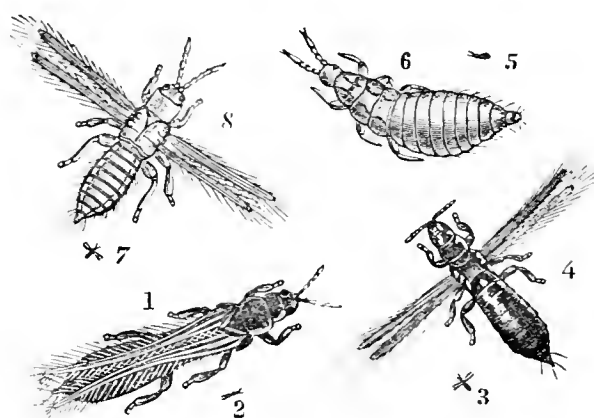
The attack of Corn Thrips is one of those which often does a great deal of harm very quietly, and without the cause of the mischief being suspected, on account of the minute size of the insect, which is scarcely more than the sixteenth of an inch long.

Thrips are well known to gardeners as being troublesome in frames, and they are also generally well known as the little black speck-like insects often seen wriggling actively about in flowers; often, too, by

* The larva differed from those of the common crop *Tipulæ* in being decidedly larger, likewise in having a tuberculated caudal proleg; this was formed of two long and pointed tubercles, each placed on a gibbous or tuberculated base. The specimens sent were of various ages, and the only description I find corresponding with them is that of Réaumur, vol. iv., p. 194, in which he says:—"The figure represents an aquatic larva of one of the kinds that produce Tipulide flies. It differs from the ground larvæ of Tipulides in the fact of the sort of horns, the round and fleshy appendages attached to the caudal extremity being longer than those of other Tipulide larvæ." The description is accompanied by a figure fairly representing the long fleshy filaments placed in a bunch beneath the caudal extremity; but I failed to procure specimens of the perfect Daddy Longlegs to which it would in course of time develop.

the annoyance they cause in hot weather by settling on the face, where they twist in all directions, holding on by their bladder-tipped feet, whence they take their German name of "Bladder-foot."

With the help of a magnifying-glass the insect will be seen to be long and narrow, and furnished with three pairs of jointed legs. Throughout their different stages the Thrips are almost exactly alike in shape, excepting that the female has two pairs of long, narrow, fringed wings. The male is wingless.



1—4, THRIPS CEREALIIUM ; 5—8, T. MINUTISSIMA.

1—4, Corn Thrips (female), nat. size and magnified ; 5—8, Potato Thrips, nat. size and magnified.

The colour of the Corn Thrips is deep yellow in the first stage, paler in the second or pupa-state, and black or pitchy when perfect. The above figure shows the female Corn Thrips at rest, and in the act of flying ; and the figure of the Potato Thrips is added to show the difference in shape of the wingless condition.

The Corn Thrips lays its eggs on Wheat, Oats, and generally on Corn and Grasses, and the insects may be found as early as June in the ears, and also in the sheathing-leaves of the stem. The injury is caused by the Thrip drawing away the juices by its sucker-like jaw-apparatus, and thus the grain shrivels and becomes abortive.

In the case of Oats, I think the amount of mischief done has not been fully worked out, for in 1883 I received specimens of Oats which were considered to be "blighted," that is, the lower part of the head was undeveloped, though there was no obvious cause. In 1884, however, I received specimens from another locality of the same kind of attack, with which Thrips were certainly present. I therefore incline to think that this failure of the lower portion of the Oat-head is owing to the habit recorded in Curtis's 'Farm Insects,' p. 285, of the Thrips attacking the Corn-stem above the knots, and so sucking away the juices as to injure the development of the ear.

On July 21st Mr. D. Byrd forwarded heads of Oats for examination

from Spurstow Hall, Tarporley, Cheshire, with the observation that he had a field of Oats much injured by a small insect answering to the description of Corn Thrips. Other insects were noted as being present, as Corn Aphis, and a few larvæ also, similar to those of the Sawfly, had been on the blade of the Oat; but with regard to the special attack it was observed that many of the heads were void of grain, this being destroyed by the very small Thrips which were inside the husk.

On examination I found Thrips present, and in November Mr. Byrd reported:—"Our Oat crop, that I named to you some time ago, must have lost fully 25 per cent. by the Thrips."

On the 2nd of August Mr. H. Stourton, of Holme Hall, near York, forwarded injured ears of Wheat as specimens of the method of attack of a small yellow insect about the twentieth of an inch long, which was then doing much damage in the neighbourhood. It was found inside the chaff at the root of the grain, and it was estimated that in some places 10 to 15 per cent. of the grains had been eaten.

On examination the Wheat proved to be much infested by Thrips, and the above description just conveys the method of attack on Wheat. The Thrip fixes itself by its sucker or jaws to the tender corn near the bottom of the grain, and thus, by drawing away the juice, causes the partial shrivelling or entire loss of the grain.

On Sept. 10th specimens of two kinds of Wheat were sent by Mr. F. W. Earle, from Huyton, near Liverpool, as specimens of an injury taking place on neighbouring land, which caused loss or abortion of the grain. This damage was also obviously in connection with Thrips.

It appears quite impossible to do anything to check Thrip-attack when once established in the Wheat-ears, by reason of the minuteness of the insects, but a good deal may be done in the way of prevention.

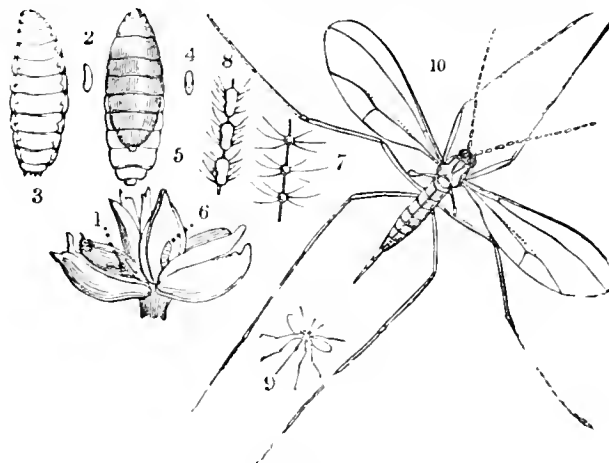
"The circumstance that Thrips are to be found in autumn (and still later) in large numbers in rotten roots, or in *stubble*, and in similar lurking-places, and also in the next spring before the development of the insect from the egg can have taken place, speaks for the hybernation of the Thrips in its perfect state, and also for its subsequent attack."* The perfect insects are thus preserved, and next spring, the females being furnished with wings, have full power to fly, or to be carried by any light breezes from their wintering places, to neighbouring corn or grass, where they will start new attack. Therefore, any measures for destroying their lurking-places would be sure to be of service; and the treatment used to prevent attack of "Red Maggot" in Wheat would be equally serviceable against Thrips.

* 'Insekten kunde,' by Dr. E. L. Taschenberg, pt. iv., p. 214.

Deep ploughing, so as to bury the Thrips well down, or dressings of salt, or anything to poison the surface of the land, would be useful where the corn was known to have been badly infested.

Removal of waste pieces or headlands of wild grass would also be desirable, as these serve as propagating grounds, as well as winter shelters, from which the Thrips come out on the corn.

Wheat Midge. *Cecidomyia* (? *tritici*), Kirby.



CECIDOMYIA TRITICI.

1—6, larvæ, nat. size and magnified; 7 and 8, part of horns, magnified; 9 and 10, Wheat Midge, nat. size and mag.; infested floret.

The following observations refer to the loss caused by presence of Red Maggot in seed of Meadow Foxtail Grass, both imported and home-saved; but they bear also on the point of maggot-attack being conveyed in seeds, and also on the Red Maggot of the Wheat, or other kinds so nearly allied as to be indistinguishable from it, being found to a large amount in grass.

On the 7th of January I received a communication from Mr. James Hunter, Chester, requesting the name of larvæ enclosed taken from seed-heads of *Alopecurus pratensis* (Meadow Foxtail Grass). These proved to be maggots of a *Cecidomyia*, and very nearly, but not quite, similar to the well-known Red Maggot of the common Wheat Midge, *Cecidomyia tritici*; and from further examination during the season it appeared that the Foxtail Grass was subject to attacks of one or more kinds of these Wheat or Grass Midge maggots.

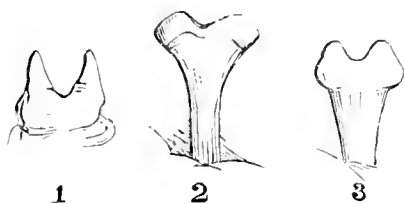
Mr. Hunter mentioned with regard to seed sent from Germany, Russia, &c., that the seed of the Meadow Foxtail harvested in 1882 contained about 25 per cent. infested by larvæ, and of course the germination of the seed was injuriously affected to that extent. The seeds of 1883, however, were only affected to the extent of 5 per cent.

Later in the season, on the 3rd of July, Mr. Hunter forwarded heads of the same kind of grass collected in the neighbourhood of Chester, of which he wrote as follows:—"Looking at this subject from a commercial point of view, if the flower-heads of *Alopecurus pratensis* grown in different parts of England are as badly infested with larvæ as those grown in this neighbourhood, both this year (1884) and last year, then it would seem that agriculturists cannot hope to save this seed for themselves in this country, and that we must continue to depend on the continental supply, which fortunately is so much less affected.

"The percentage of seeds of *Alopecurus* infested by larvæ which I have examined since last harvest (of continental growth) would average about 5 per cent., perhaps less, but were seeds saved from the heads forwarded [to myself, ED.] last week, I believe 75 per cent. would be found non-germinating from the presence of these larvæ."

The heads sent were badly infested; many of the orange-red maggots were still to be found at the base and within the florets, in which case I did not find forming seed; and it is important to notice that, after the box containing them had been placed for a day or two in a damp situation, some of the maggots were crawling out of the heads, a point to be referred to presently amongst considerations of prevention.

The maggots sent successively accompanying the above observations were all of some kind of *Cecidomyia*, but they varied slightly among themselves in depth of colour (which may not be an important difference), but also in the shape of what is called the "anchor organ," the forked process lying beneath the maggot pointing forward from the third ring from the head, and also in this process being sometimes



2, Anchor process of Wheat Midge maggot; 1 and 3, of Foxtail Grass maggot.

absent. The form of this process, or "anchor organ," as it is sometimes called, is one of the points of distinction between *Cecidomyia* maggots, and in the Red Maggot of the Wheat it is somewhat lunate, as shown at fig. 2.*

* Fig. 2 is given by permission from a much magnified sketch of the anchor process of the larva of *Cecidomyia tritici* taken by Prof. Allen Harker, of the Royal Agricultural College, Cirencester, who is pursuing the subject of investigation of the form of this process in other *Cecidomyiæ*, which may prove of much service in identifying the species. The skin of fig. 1 was somewhat shrivelled.

Some of the specimens of the *Alopecurus* grubs were furnished with a lunate process, which appears to me similar in characteristic shape as shown at fig. 3; some with a more pointed form figured at 1; and in some the process was wanting.

From this I infer that the Red Maggots were of various kinds, *some* of them the larvæ of *C. tritici*, but they were apparently alike in their habits; and this view was confirmed by observation of insects in their complete state—the Wheat or Grass Midges of the Meadow Foxtail Grasses—forwarded later in the season by Mr. Edmund Baillie, also from the neighbourhood of Chester.

Mr. Edmund Baillie's communications on the subject of the *Alopecurus* Red Maggot began on May 8th, when he mentioned that in the course of an examination of a sample of seed of the Foxtail Grass a few years previously he found many of these seeds contained this small yellow maggot, which was, after microscopic examination, identified as the larva of a *Cecidomyia*, and considered to be that of *C. tritici*,—that is to say, was considered to be the common Red Maggot of the Wheat Midge.

Pursuing the subject as to date and amount of the appearance of the midges on the Foxtail flowers, Mr. Baillie wrote, on June 10th:—
“I had an hour with the Foxtail Grasses this evening, and send some of the midges. On this evening they were noticeable in great numbers; ‘I could have got hundreds.’”

On June 25th Mr. Baillie spent from six to eight in the evening in the meadow:—“I lay down amongst the grasses and carefully examined the lower lying foliage leaves, gently disturbing the stalks about me. I then found a number of the midges amongst the grasses,—tried for two hours to catch them, but could not get one!”

At 10.30 p.m. Mr. Baillie secured a few specimens. The following morning (June 26th), at 5 a.m., he only secured two, but again in the evening they were plentiful. “This evening I renewed my search, and was successful in finding them in abundance. I watched their habits closely for a time. I find they *rise from the lower leaves, fly about until they rest either upon the head or upon the stalk of an inviting grass; invariably, so far as I see Alopecurus*. One alighted upon the stalk, ran rapidly up it until it reached the head, and there remained contentedly.”

This account of the habits precisely agrees with that given by Mr. Kirby (‘Transactions of the Linnean Society,’ vol. v.) of the habits of the Wheat Midge, in which he mentions that the midges “were seldom to be seen much before seven o’clock, *at eight the field appeared to swarm with them*; but, though so numerous in the evening, not one was to be found on the wing in the morning.” They do not, however, then quit the field which is the scene of their employment, for upon

shaking the stalks of the Wheat, or otherwise disturbing them, they will fly about near the ground in great numbers. "I found their station of repose to be upon the lower part of the culm, with their heads upwards."

I give Curtis's figure of the "Wheat Midge," here alluded to, at the head of this paper for convenience of reference. The specimens forwarded to me by Mr. Baillie almost exactly resembled this kind, the *C. tritici*, but I could not take upon myself to say whether they were *precisely the same species* or not. I therefore forwarded them for the benefit of thoroughly skilled examination to Mr. R. H. Meade, of Manningham, Bradford, who stated the insect belonged to the *Cecidomyia*, subgenus *Diplosis*, H. L. W., and he considered it was probably a new or undescribed species. The specimens sent might possibly be small varieties of *C. tritici*, but as all that were sent were females the kind could not be determined with certainty.

On the 18th of July attack from the midges mentioned above was set up in the heads of the Foxtail Grass, and Mr. Baillie reported:—"I find the larva of *Cecidomyia* present, now so far advanced as to admit of proper examination. I yesterday took one head and analysed the seeds, dissecting them and examining them with sufficient care to enable me to say that the result here given is about correct. I found the head composed of 'seeds' as follows:—187 apparently empty and unopened glumes; 179 'filled' seeds of good quality; 75 containing larvæ."

The maggots, of which specimens were sent, proved to be of the Red Maggot with the somewhat pointed anchor process.

We have thus the complete season's observation: maggots found in the dry seed which had been harvested; the midge at work laying eggs in June; and the beginning of the attack of maggots in July; and I have given Mr. Baillie's careful observations in detail, as thus we have proof of the habits of this midge, and the Wheat Midge, being so similar that it may be presumed all methods applicable for prevention of the Wheat Midge are applicable to the Foxtail attack.

These turn mainly, as has been mentioned in previous reports, on such treatment of stubble as will destroy the maggot sheltering at the corn or grass roots; as, for instance, collecting stubble-roots in heaps and burning them; likewise deep ploughing, which will bury the maggots; and likewise so treating infested chaff as to destroy all maggots in it. Further, the *removal of wild grasses*, which may be food-plants for the maggots, from round corn-fields; which treatment is proved to be eminently desirable by the present observations of the extent to which "Foxtail" is infested.

This matter of the Red Maggot has to be looked to in the double light of both a corn and grass seed pest, and where Meadow

Foxtail is grown for seed, extra care will be needed as to Wheat grown near.

As yet it has been considered impossible to apply any remedy in the growing corn for Wheat Midge attack, but the observations given above of the midges *lying quietly during the day amongst the lowest leafage* of the attacked corn or grass seems to point to the possibility of some good being done by throwing dressings. So far as growing *Alopecurus* in patches for seed is concerned, the plan might be tried of throwing applications of the same kind as those used for Turnip Fly. A mixture of one bushel of fresh gas-lime, six pounds of sulphur, and ten pounds of soot, thoroughly mixed and powdered as finely as possible, was enough, in Mr. Fisher Hobbs' practice, to dust two acres of Turnips. If this or any other similar mixture with sulphur in it was applied when the dew was on in the morning, so as to adhere to the lower leaves whilst the midges were resting amongst them, it is very likely many would be killed, and also the leafage made thoroughly obnoxious as a shelter. Should the experiment be tried notes of the result would be very acceptable for publication.

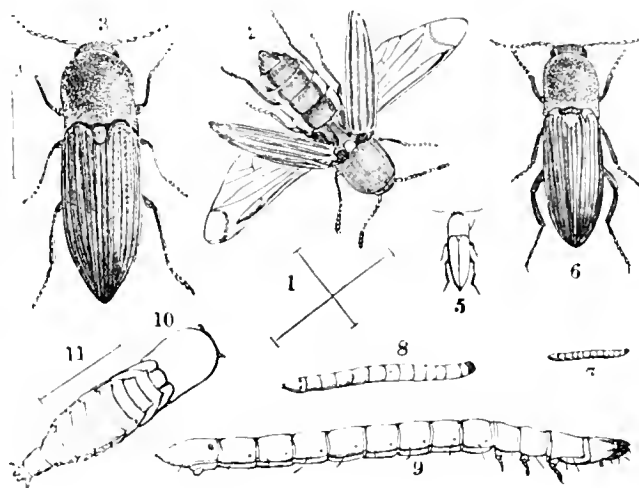
With regard to the special point of clearing the maggots from "Foxtail" seed, Mr. Hunter informs me that, "if *Alopecurus* seed is highly winnowed, most of the larvæ-infested seeds are separated from the good seed (although some good seeds are also taken out in the process), the reason being that a larva is not as heavy as a well-developed seed, and so it is driven out."

The enquiry has been made whether the use of seed of which a considerable proportion was infested by these larvæ would have any injurious effect on young pastures, it being borne in mind that the pastures are merely for grazing, and *not for the production of seed*? Where this is strictly the case no damage would arise to the pasture from the use of infested seed beyond the loss of the amount of seed killed by the maggot, because, as far as we know, the "Red Maggot" only feeds on the seeds or in the blossom; but in the broad question sent in from another quarter as to whether *sowing infested seed produces an infested seed crop*, the answer is not so certain.

From experiments tried there seems some reason to think that sowing the seed with the maggot amongst it is followed by attack, and from the winter state of the maggot this seems likely enough.

Of the maggots sent me in *Alopecurus* seed in the winter, some appeared dead, but I am far from being convinced that they *all* were past recovery; and if so, putting them in the ground with the seed would be putting them in just the right place for development, and for the midges in due time to come out from, and infest either the crop with which they were sown, or neighbouring Wheat.

Click Beetles and Wireworms. *Elatér (Agriotes) lineatus*
(and other species).



ELATER LINEATUS, &c.

1 and 2, *E. lineatus* ; 3 and 4, *E. obscurus* ; 5 and 6, *E. sputator*, nat. size and mag. ;
7, larva of *E. sputator* ? ; 8 and 9, larvæ of *E. lineatus*, nat. size and mag. ;
10, pupa. Lines show natural size.

The following carefully-detailed note, sent by Mr. James Davies, Bollington, near Altrincham, Cheshire, draws attention to operations sometimes completely failing to clear the ground of Wireworm (or other insect vermin), because they are at that time gone down too deep in the earth for measures of cultivation to reach them. Mr. Davies wrote as follows :—

“ Three years ago [that is, at Christmas, 1880,] I had a field of grass-land which I intended to plough for Oats. The frost was very severe. When the frost left we had a good deal of rain (so much as to prevent ploughing on *broken* land), so I began ploughing this grass-field *as soon as the frost was out*, ploughing in different parts of the field, setting ridges, and ploughing round each.*

“ By the time we had done this much the broken land had dried, and we went to plough it, reserving *the rest of the grass* for another wet time. We finished the grass in the beginning of March, and in due time the field was sown with Oats.

“ Then there was to be seen this difference. On the land *first ploughed the Wireworm took nearly every Oat*, and we had to sow it again. On the land *ploughed later there was hardly any damage*.

“ I accounted for the fact in this way—probably the severe frost caused the worms to go down into the earth before it to a depth from *which they had not risen when the first ploughing was made*, and (probably

* A plan accompanying showed the grass field divided into seven strips, of which the three ploughed just after the frost lay alternately between the four ploughed later on.

also) they *had risen to furrow-depth when the second lot of ploughing* was done, and so (on this part) they were exposed as prey to birds."

The above observations of Mr. Davies are quite in accordance with the habits of the Wireworms. They go down deeper and deeper into the ground in winter as the frost becomes more severe, and consequently the ploughing, &c., which would throw them to the top in mild weather, is of no service in getting rid of them if applied before they are come up again to their regular feeding level.

The three following notes turn chiefly on the importance of *healthy growth* in carrying the plant through attack, with some observations *as to effect of rolling*.

Mr. T. Aitken, writing from Spalding, observes:—"I am sure that I should have the evidence of most farmers that generally the greatest damage has been done more upon lands wanting in fertility than those receiving frequent applications of well-made farm manure that is produced from highly-fed stock. Indeed, the best remedy I know is land in a good state of cultivation so that the plants are vigorous, and even when cut by the Wireworm, capable of taking a fresh start. This fresh start is often assisted or made possible by the using a heavy roll, or by trampling, saving many a *damaged* plant from destruction by late spring frosts, which, coming when the land was open, destroyed all the weak plants.

"I note that many of your correspondents strongly recommend the making of the land as firm as it is possible, of which treatment I fully approve, as it makes the light land more suitable for the Wheat crop, not that it will stop the working of the insect. [The pressure will not entirely check the movements of the Wireworm, but still any difficulty thrown in the way of travelling will be useful in lessening direct amount of injury, besides the benefit to the plant from the soil being firmed round it.—ED.]

"The ploughing seed land with a light shallow furrow is also a good system, the Wheat roots growing better if there is a firm subsoil within reach.

"We sometimes have a considerable loss of grain at harvest-time arising from shake; this produces a quantity of Wheat plants in the following crop of Clover, and I never noticed any damage done to these plants by Wireworm. If this should be the experience of others it would be interesting to have the reasons why."

On the 5th of May, Mr. A. Bannester, writing from Barling, Essex, observed:—"With regard to Wireworms, they are, in this neighbourhood, more than usually troublesome. I have lately saved a crop of Barley (fourteen acres) by the early use of a very heavy stone roller. The Barley in question is now most luxuriant (lately dwindly and yellow), and the roots of the crop prior to the application of the

roll literally swarmed with Wireworms. The previous crop was Potatoes."

Mr. P. Loney, writing from Marchmont, Berwickshire, on the 19th of June, mentioned that there were several patches of Wireworm in the county, but not to any great extent, and good had been done by the application of *top-dressing to Oats and other crops*, thereby giving a more vigorous growth and pushing the plant on as much as possible beyond the destructive effects of Wireworm or grub, as the case might be."

The following observations by Mr. Sturdy, of Trigon, Wareham, give the results of experiments he kindly undertook, at my request, to ascertain the effects of Indian rape-cake on Wireworms.

This point is of very practical interest. I experimented myself in 1882 as to the effect on Wireworms both of the common rape-cake and also of the so-called Indian or Kurrachee rape-cake (which is, in fact, mustard-cake) with the result of the Wireworms being *in no way the worse for being fed on the common rape-cake*, even in the case of this moistened with water being their sole food.

With regard to the Indian cake—that is, mustard-cake—there appeared reason to think it might be poisonous to them: we are all well aware of the good effect of mustard as a clearing crop for Wireworms, and in experiments in which Wireworms were solely fed on this mustard-cake they appeared to be partially or wholly poisoned by it. Therefore, at my request, in order that we might make out what would happen in fairly natural circumstances, Mr. Sturdy carried on the experiments with Indian rape-cake applied as manure to Oats sown in boxes, so that we might be sure of all points noted, but at the same time the Wireworms could choose their own food.

The experiment extended over rather more than a year—from March, in 1883, to May, 1884—and the result, as given in detail below, shows that the Oats manured with the Indian rape-cake, or mustard-cake, throve much better than those that had none; that the Oats so manured were *little attacked compared to the others* not manured; further, as time went on, the Wireworms in the box where there had been no rape-cake duly went through their changes to Click Beetles; but on May 1st—that is, fourteen months after the commencement of the experiment—the Wireworms in the Indian rape, which are noted as having had "no food for many months but this rape-cake," still continued Wireworms, and fat and well.

I repeat the first part of Mr. Sturdy's observations, begun in 1883, to make the record complete:—

"Two boxes were sown with Oats in March, and when about two inches high one box was well larded with bits of the Kurrachee Indian rape-cake you sent me: the bits were about the size of hazel nuts,

Twenty Wireworms were then put into the Oats with the rape-cake and twenty in the Oats without, and so they were left. The *Oats with the rape-cake flourished exceedingly* compared with those that had none, and the former (the rape-cake Oats) were scarcely touched by the Wireworms, while the latter were a good deal injured. This day (May 1st, 1883) I turned out the rape-box, hoping to find all the Wireworms *non est*, but instead I found everyone looking fat and well."—"Report on Injurious Insects," 1883, p. 39.

On January 31st of this year (1884), Mr. Sturdy further reported :—"On looking at the boxes I found that the lot that had Oats to feed on became ordinary Click Beetles, but that those that had E. Indian rape-cake *only* were still large and well-to-do-looking Wireworms, and so they still remain to this day" (Jan. 31st).

"The result of the experiment is that the rape-cake, instead of being poison to the Wireworms, evidently prolongs their destructive lifetime. How long they will continue to live and flourish in the rape-cake you sent me and water I can at present form no opinion."

On May 1st Mr. Sturdy forwarded the completion of his experiment, which is conclusive as to this diet not being necessarily fatal :—"I have now had the remainder of the Wireworms turned out of their box. They *look fat and well* after feeding on nothing but the rape-cake you sent me for many months."

I do not think we can be absolutely sure that the Wireworm-stage is prolonged by the diet of the Indian rape without further experiment, although it certainly appears to be the case. The Wireworm being very long-lived, it *may* have occurred that those in the Indian rape were somewhat younger ; but the clear evidence from parallel experiments of the Oats manured with the Indian rape being the heartiest in growth, and likewise being much less injured by the Wireworms, is a very good piece of observation of practical service.

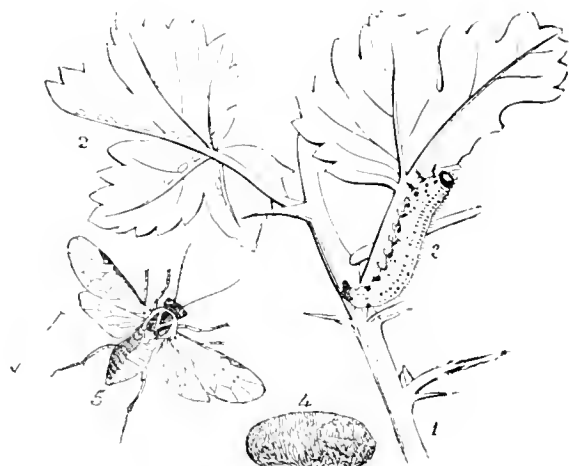
GOOSEBERRY.

Gooseberry and Currant Sawfly. *Nematus Ribesii*, Curtis.

Mr. W. J. Goodwin, of Winfield House, Crouch, Sevenoaks, notes that he considers "the best remedy for Gooseberry caterpillars is to give a liberal sprinkling of fresh good soot early in the morning when the trees are damp, two or three large handfuls to a good-sized tree, so as to make it *quite black with soot*. It is of no use unless it is done when the trees are *damp, so that it sticks on well*. If it comes off by rain coming shortly after, it must be done again. It acts, of course, as

a first-rate manure afterwards, causing the trees to make good wood for another year.

“The caterpillars always first appear on leaves in the middle and bottom of the trees, and may be detected first by a few small holes in a few of the leaves, resembling prick-holes of a pin. This is the best time to apply the soot.”



NEMATUS RIBESII.

Sawfly-caterpillar; cocoon, mag.; Sawfly, mag.; line showing nat. length.

Mr. Kay, Barone Cottage, Rothsay, N.B., mentions :—“The caterpillar made considerable havoc not only amongst the Gooseberries, but amongst the Currant bushes, a thing that had not been seen before. I may state that I did not give the ground the usual *coating of paraffin in the spring*, and probably the grubs may have made headway on that account.”

The attack of Sawfly-caterpillars on Gooseberry leafage is one which appears certain to appear more or less every year, and often, and especially in bush-fruit growing districts, causes great loss to the growers. As it has now been reported yearly since 1878 inclusive, with various methods of prevention and remedy found to answer for keeping it in check, it may be of use to give a list of the most service-of these under special heading.*

Handpicking the Caterpillars, or shaking them down and destroying them.

“Handpicking, *if taken in time*, the best remedy.”—ALEX FORBES.

“Handpicking found to be the most satisfactory remedy.”—C. GRIERSON.

..... “On attack being observed put on hands at once, and

* It will be observed from the names appended that the information with which I was favoured was almost entirely contributed by well-known Scotch or English horticulturists, or by large growers in the bush-fruit district in the South of England, of which the addresses are given in full in the respective Reports.

cleared the garden; and thus, although very numerous, the insect was checked."—D. S. SCOTT.

"Had the caterpillars shaken from the bushes and crushed."—J. SUTHERLAND.

.... "Prevented serious injury by shaking down the caterpillars whilst quite small and crushing them on the ground, and by hand-picking later on."—T. H. HART.

"Trees found to be attacked were immediately well syringed and shaken, the caterpillars dropping on to the soil, where they were treated and burned with hot lime."—W. WARD.

"The most serviceable, and, in the end, cheapest remedy, is considered to be to lay a piece of canvas sufficiently large to cover the surface of the ground under the trees attacked, and give the trees a good shake, thus dislodging the caterpillars, then have the canvas removed and the caterpillars destroyed."—A. SMITH.

..... "Crop was only saved by handpicking, and shaking the caterpillars on to sheets placed under the bushes."—Rev. F. ADAMS.

Dusting infested bushes.

The application which appears most surely serviceable is dusting the caterpillars with powdered hellebore, but, without great care and washing of the fruit, this poisonous dressing is likely to prove so injurious to those who partake of the fruit afterwards that I cannot take on myself to advise the application. With regard to sulphur and soot, the advice given above by Mr. Goodwin at p. 39, and below by Mr. McCorquodale, as to applying them when the bushes are damp, so that the powder should adhere, should be particularly observed.

"Flour of sulphur dusted on the leaves *when the dew is on*, or, if in dry weather, after watering; only necessary to dust the lower part of the bushes if taken in time."—W. MCCORQUODALE.

..... "Used sulphur powder, as recommended above, and found it as useful as hellebore powder, without fear of possible evil consequences."—J. W. WHITTON.

"Trees were dusted with hot lime and soot, and there was no further trouble with the caterpillars."—W. WARD.

"A few handfuls of roached lime thrown over the infested plants stopped the evil."—T. BRUNTON.

Paraffin as watering in spring and washes to the infested bushes. (For method of mixing paraffin washes, see "Paraffin," "Wash," and "Emulsion" in Index).

"Gooseberry Sawfly-caterpillar only appeared slightly. A watering of paraffin had been given early in the spring to the stems of the bushes and the ground beneath them."—J. KAY.

"Paraffin, in the proportion of four ounces to a gallon of water,

was decidedly serviceable, but could not be used after the fruit was ripe."—T. H. HART.

Autumn or Winter removal of surface-soil from under the bushes.

For prevention of all attack, excepting what may be borne on the wing by stray Sawflies blown from elsewhere, I believe the above plan to be the most certain.

The caterpillars go down in autumn a little below the surface, the depth varying from about two inches to somewhat more, according to nature of ground. There they lie in small brown cocoons, like little pellets of earth, during the winter; and when the leafage comes out in the spring, so do the Sawflies from their cocoons under the bushes, and lay their eggs to start attack on the leaves. If the earth is removed, with the cocoons in it, and got rid of in any way the amount of attack is enormously lessened.

"For twenty years Gooseberry Sawfly-caterpillars have not occurred in the gardens under treatment, in any quantity. The surface-soil under the bushes is annually removed in winter, a deep hole is dug in one of the quarters, and in this the removed soil, *with whatever may be in it*, is buried. The soil under the Gooseberry bushes is replaced by that out of the hole, with the addition of some manure."—ALEX. ANDERSON.

"When there is reason to fear an attack [*i. e.*, when there has been bad attack the previous year, ED.] the soil should be removed to the depth of two inches round the bushes in the early spring, and a good sprinkling of lime dusted round each bush; by this means the caterpillars are cleared away and destroyed."—GEORGE MCKINLAY.

"Caterpillars not nearly so injurious as last season. During the winter I removed all the surface-soil from under the bushes."—JOHN MATHESON.

"Gooseberry bushes in my garden, from beneath which the earth had been scraped a few inches deep in the previous autumn and replaced by manure, &c., were free from attack."—ED.

I have also a note from a gardener in this district near Isleworth, where Gooseberries are largely grown, that one method of treatment is to scrape all the surface from beneath them in the autumn and to form it into a line between the rows of Gooseberry bushes, and there *dig it in*.

In this way a great amount of attack is prevented, but it is necessary to be careful as to having the scraped-off surface-soil *dug in thoroughly*. On one occasion I saw the first part of the operation carried out on a large scale,—the earth was scraped from under the bushes and formed into lines between them,—but there work stopped; consequently the cocoons lay just as safely as if nothing had been

done, and when spring came the Gooseberry leaves were again riddled by the caterpillars.

Dressings of Gas-lime and Lime.

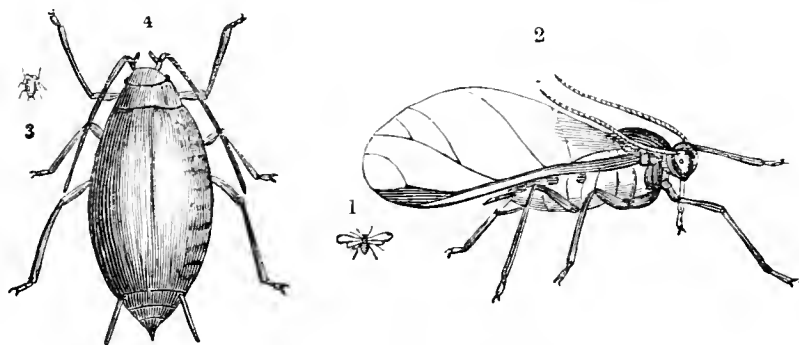
"I dress over all my Gooseberry-ground with gas-lime in early spring before forking over the soil, and have not seen one of these caterpillars for three years."—T. BOYD.

"I am now satisfied that I have benefited by the application of gas-lime between my bushes. Grubs there certainly have been, but, whilst they have almost stripped other bushes of their leaves, those on the dressed ground are little the worse for the attack."—T. H. HART.

"Currants and Gooseberries in the open garden have kept free from attack. I think this was owing to the trees being dressed with lime early in the spring. Currant trees on the wall *not* dressed with lime were attacked."—A. WARD.

H O P.

Hop Aphis, and Damson-Hop Aphis. *Aphis (Phorodon) Humuli*, Schrank; and *Aphis (Phorodon) Humuli*, var. *Malaheb*, Fonsc.



APHIS (PHORODON) HUMULI.

Winged and wingless Hop Aphis; nat. size and mag.

During the past season I have been in receipt of specimens and observations relative to Hop Aphis attack from the latter part of March to about the end of August, and, though I should be far from expressing positive certainty on a subject like this which has been one of doubt and difficulty for at least a hundred years, yet, after careful study and also comparison with the published views of entomologists who have attended to this special attack in England, Germany, and the United States of America, it appears to me that there is good reason for believing the course of attack to be as follows:—

1st. That the first attack of Aphis to the Hop begins in spring

from wingless females (depositing living young), which come up from the Hop-hills.

2nd. That the great attack, which usually occurs in the form of "Fly" about the end of May, comes on the wing from Damson and Stoe, as well as from Hop, and that the Hop Aphis and the Damson-Hop Aphis are very slight varieties of one species, and so similar in habits as regards injury to Hop that for all practical purposes they may be considered one.*

Further, it has been shown by the result of various experiments on the Hop-ground at Stoke Edith Park, Hereford (allowed us by the kind courtesy of the Lady Emily Foley) that the use of various applications round the hills in the late autumn, or about the beginning of April in spring, completely prevented attack to the vines of those hills until the summer attack came on the wing.

Amongst these applications paraffin was especially noticeable, as the plants treated with it were reported throughout as thriving up to the point of bearing well; and the serviceableness of mineral oil, both as a preventive and remedy, has been confirmed by the reports of experiments, regarding the use of petroleum and kerosine in dilute state, published by direction of the Department of Agriculture of the United States of America, and of which I give notes under the head of "Kerosine Emulsion."

The following are details of the main points of the information contributed or acquired from various sources regarding Hop Aphis and its prevention during the past season.

With regard to first appearance of Aphides on the Hop, Mr. C. Whitehead, writing from Barming, near Maidstone, on the 29th of March, mentioned:—"I have found the enclosed Hop-shoot, with the larvæ *in situ*, in my Hop-ground this morning. There was a wingless female, which had evidently deposited viviparously the larvæ enclosed." Regarding the state of shoot at the time Mr. Whitehead wrote as follows:—"There is in most places no shoot visible, as most grounds are dressed, that is, all old shoots and early shoots cut off. I dress late, and so I have plenty of shoots which will be cut off soon, and upon these I found the lice I sent to you.

"I went out in the afternoon, and found lice upon many hills, to the great amazement of the men. They say they never saw such a thing so early.

"Where there were small lice, in most cases a wingless viviparous large active female was not far off.

"I found them chiefly in a part sheltered from cold winds, and

* By Hop and Damson-Hop Aphis I mean the *Aphis* (*Phorodon*) *Humuli*, Schrank, and the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb*, Fouse.; but in no case the *Aphis Pruni*, Réaum., or any other kind.

where hatching or awakening from hybernation would be early. I should say I found a hundred at least in ten minutes."

On the 31st of March Mr. E. Goodwin wrote, from Canon Court, Watlingbury, Kent, that nearly all the Hops had been dressed; but he had carefully searched in the young shoots, and found some lice in Grape Hops, but could find no signs of any in Golding Hops.

Continuing the observations in order of date, early in April, I heard from Mr. Whitehead that he had found more lice on Hop-shoots; that two farmers had just called and brought more; and on the 10th of April he mentioned that attack had been found on the Hop-shoots in several places in East Kent.

On the 12th of April Dr. T. A. Chapman, writing from Hereford, reported that after careful search in the Hop-yards, where the bine was two feet high, he could find *no trace of "Fly,"* but on the following day he found a bine with seven or eight Aphides on it. These were wingless and nearly full-grown.

In these observations we have clear instance of the wingless females, and the lice being present at the hills in the early spring, long before any appearance of the "Fly" (or Aphis in the winged state), in which it might have been borne on the wind from elsewhere.

This point is strongly confirmed practically by the experiments in the Hop-grounds at Stoke Edith Park, near Hereford. Here it was found that bines from the hills which had been treated (in autumn after the bines were cut, or in spring before or when they were shooting) with various applications suitable to *prevent Aphis effecting a lodgment or coming up through the soil* were perfectly clean (though the rest of the Hop-yard was infested) up to about the end of May, when attack of *winged Fly* began.

Some of these plants had been watered with paraffin and water, and with salt and water in the autumn after the bine was cut, and altogether upwards of 1200 plants were experimented on by Mr. A. Ward with applications of paraffin variously mixed with ashes, sawdust, sawdust and ashes, and also with shoddy; likewise with lime, salt, salt and lime, salt and ashes, soot, gas-lime, and gas-lime and soot.*

A plant also, which had been carefully enclosed under muslin, and of which the ground round the hill had been well watered with paraffin and water, remained free from attack; whereas the one similarly secured last year under muslin, of which the hill had *not* been cleared of attack by dressings, was then smothered with Aphides coming up from the hill.

To recapitulate: we have thus (with regard to the beginning of the attack of the year) evidence of the wingless females being seen

* Details of amount of application and effect on the plant given further on.

depositing lice in many places; we have likewise notes of their total absence on upwards of 1200 plants, of which the hills had been dressed with applications to prevent attack, and the confirmatory experiments where the plant was enclosed under muslin; of attack being *set up* where nothing preventive had been done to the ground round the stock before enclosure; and on the other hand the plant remaining *perfectly clean* where preventive applications had been applied.

After being fairly set up as lice, the attack, as a matter of course, progressed to the full-grown stages; and the following note by Miss Golding, from Plaxtol, Sevenoaks, is, in fact, a history of its regular method of increase. Writing on the 12th of May, Miss Golding mentions that before the colder weather in April she noticed large green wingless Aphides, or a large one and smaller ones together, on Hop leaves, and at (the above mentioned) date of writing she found under the small red sheath at the base of the leaf-stalk numerous Aphides. These were yellowish for the most part; some Fly with green bodies, and also some with "fin-shaped markings on the sides,"—that is, with the embryo wings showing the stage just before the Fly gains its wings.

I also found Fly appearing in a Hop-ground at Sharsted Court, near Sittingbourne, on the 23rd of May.

On the 26th of May specimens of Fly were sent me by Mr. C. E. Edwards, of Marsh Court, Hereford, from bine in a ground about twelve miles distant from thence; and on the 3rd of June he reported Fly as well as lice as being plentiful in another Hop-garden near Hereford.

The above details give the history of the Hop Aphis, *Aphis* (*Phorodon*) *Humuli*, Schrank, distinct from any other, from its coming up from the hills to its early summer commencement of Fly-state. Now I will similarly trace the history of the Damson-Hop Aphis, the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb* (Fonsecolombe), from its appearance at the same time as the Hop Aphis in spring to its change to the Fly stage at the end of May, and then point out the reasons (or what appear to me to be such) for considering these Aphides to be very slight varieties of the same species.

The first appearance of the Damson-Hop Aphis, i. e., *Aphis* *Humuli*, var. *Malaheb*, on Damsons was a little before March 25th; on that day Mr. E. Goodwin, of Canon Court, Watlingbury, Kent, wrote in continuation of previous observations (to Mr. C. Whitehead):—"I am forwarding you some more of those Aphides. A number of young ones have appeared, which you will see swarming round the old ones on the Damson buds I have sent you. The old Aphides appear to be decreasing rapidly."

These larvæ, or lice, I found agreed precisely with the lice from Hop vines.*

On the 12th of May I received information from Mr. W. Gardner, of Bekesbourne, near Canterbury, of the appearance of these Aphides on Plum, and specimens of wingless females and lice forwarded by him three days later corresponded in characteristics with the true Hop Aphis.†

A week later—that is, on the 22nd of May—Mr. Gardner reported that since observing the Aphides on Plum he had carefully examined his Hop-ground close by, but there was no appearance of Fly on the plants until that morning; and still there were no lice, excepting such a small number that he forwarded them in a quill.

On May 29th Mr. R. Cooke, writing from Detling, Kent, showed the gradual march onward of attack by mentioning the “increase of vermin: washings of Damsons and Plums had been going on a fortnight, and Hop washing had certainly been commenced [on the day of writing] in one ground in Farleigh parish. The grounds at Detling were still fairly [clean.”

The disappearance of the Damson-Hop Aphides from Damson and Sloe was reported on the 26th of June from Watlingbury, near Maidstone, by Mr. R. H. Fremlin, as follows:—“I now send you Aphides from the Sloe, but I cannot find any on the Damsons; they appear all gone, and very few left on Sloe, and correspondingly diminished numbers come to the Hops.”

The specimens forwarded had tubercles on the forehead, swollen or slightly gibbous base to the lowest joint of the horns, and long honey-tubes—in short, were either the common Hop Aphis or its variety, the Damson-Hop kind, if, indeed, it is distinguishable enough to be called a variety. It was also to be observed that almost all the specimens were on the point of passing to the winged state.

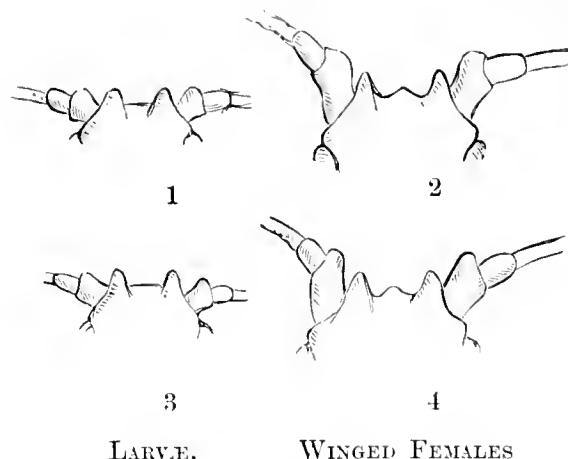
Now, looking at the history of the Hop Aphis and of the Damson-

* From this time up to about the middle of June, after long and repeated examinations, the lice of the Hop and Damson-Hop Aphis in their first stage (that is, shortly after being produced) appeared to me to be indistinguishable.

† In identifying I have mainly considered the development of the frontal tubercles, and also the form of the basal joint of the horns (antennæ); likewise the length of the honey-tubes or cornicles. Amongst the many observations sent me some few occurred which, from the specimens sent accompanying, obviously belonged to the *Aphis Pruni* of Réaumur, that is, the common “Plum Aphis,” not to the kinds under observation. All communications relatively to *this kind* have been most carefully removed, as it has nothing to do with the subject; and also because it so much resembles the *Aphis Humuli* and its variety *Malaheb* in general appearance, that its presence, and especially it being obviously ready for egg-laying in late autumn, has much added to the intricacies of the subject.

Hop Aphis slide by side up to this point, we find them starting at the same time in spring respectively on their several plants, continuing similarly to increase ; and similarly about the end of May to gain the winged state ; and up to this date, by constant microscopic examination, I did not find any difference in the frontal development of the young lice of the kinds under consideration when first produced, nor in that of the winged females.

The accompanying figures, drawn from life, show the similarity.



1, 2. Hop Aphis ; 3, 4. Damson-Hop Aphis.

During June, that is, when Fly is considered (both by many Hop-growers and also entomologists who have studied the point) to be leaving the Damsons, and is certainly appearing on the Hops, specimens were still sent me ; and on the 26th of June, when a correspondent especially attending to this subject reported that he could find none left on Damson and few on Sloe, I considered his observations confirmed, and likewise the theory of migration, by the fact that all the specimens he sent me were winged pupæ—that is, had embryo wings—which showed they would soon turn to the winged state, *i. e.*, to Fly.

I think this is very important, for the fact of all that remained on the sprays sent me being winged or forming wings, joined to previous departures, points to the absentees having *flown somewhere*. They had not died, or they would have been found on the bushes ; they have not, as far as I am aware, ever been found infesting any other food-plants than Hop and Plum of various kinds ; and with regard to these food-plants, we find the Aphides, as just mentioned, forming wings, and leaving the one set of plants just when attack is appearing on the other. Regarding migration, see 'Brit. Aphides,' vol. i., p. 74.

That such migration does take place in Aphis life we have direct testimony. M. Jules Lichtenstein indeed states that "in the greatest part of plant-lice the second form is winged, and flies away from the

place where it was born ;* but just taking one or two special examples of migration from one kind or one species of plant to another, we have the common Bean Aphis or Collier (*Aphis rumicis*, Fab.), which often hybernates (and sometimes lays its eggs) on the Common Furze, and thus affects this plant both before and after the growth of its better-known food, the Field Bean.

As an example of migration to and fro on the wing from one species of plant to another, we have the Oak Aphis, *Phylloxera Quercus* (Fonscolombe), which is stated commonly to deposit its eggs in the bark of the Chermes Oak; in due course winged females appear about the end of May, and are stated *all* to migrate to the Hairy Oak, *Quercus pubescens*, whence further generations were seen, by M. Lichtenstein, to return to the Chermes Oaks in August.†

With regard to evidence of the migration of Hop Aphis (whether we call it the species *Humuli* or the variety *Malaheb*) from Plum to Hop, we have the direct statement of several competent entomologists to the effect of their knowledge of this taking place.

The German writer, C. L. Koch, in his well-known work on Aphides, states that in the last days of the month of May the Hop Aphis (*Aphis Humuli*, Schrank) are to be found in large companies on the young shoots, and on the under side of the leaves of Plum and Sloe. In these companies the writer observes that only one mother Aphis was found: *all the descendants present were either already winged individuals or larvæ of the same. Not one example of the larva of a wingless specimen was to be found there.*

After details of description the writer continues :—In the month of June these plant-lice forsake the leaves of the Sloes and betake themselves to the wild and field Hops, where they often cover the under side of the leaves with their vast numbers.‡

With regard to this same Hop Aphis, it is stated by J. H. Kaltenbach, in his exhaustive work on insect plant-pests,§ that the *Aphis Humuli* (Schrank) often lives from July to September under the leaves and on the upper part of the stems of the Hops in numerous companies, and that *he had found it also as early as May on the Sloes.*

Francis Walker, a well-known English entomologist, mentions that this same Hop Aphis develops on Sloes, and the second generation migrates from thence to the Hops, but returns again later on to the Sloes.||

Further, we have the opinion of Mr. G. B. Buckton, which is of

* Letter from M. Jules Lichtenstein to G. B. Buckton, F.R.S., 'Brit. Aphides,' vol. iv., p. 65.

† 'Brit. Aphides,' vol. iv., pp. 49, 50.

‡ 'Die Pflanzenlaus-Aphiden,' von C. L. Koch, p. 115.

§ 'Die Pflanzenfeinde aus der Klasse der Insekten,' pp. 176 and 534.

|| 'Ann. of Nat. Hist.' xx., p. 209.

great value, both from his personal observation and from having compared and weighed the opinions of many entomologists, and he states that he considers the *Malaheb* to be a variety of the species *Humuli* (above mentioned), and that it is common on the Sloe and Plum in May and June.*

It is also stated by Dr. C. Thomas, State Entomologist for the United States of America, State of Illinois, that he considers the *Malaheb* (Fonsc.), *i. e.*, the Damson-Hop Aphis, is but a variety of the species *Humuli*.†

In all these observations I have been careful to limit them to the Hop Aphis, the *Aphis* (*Phorodon*) *Humuli*, Schrank, and its variety, the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb*, of Fonscolombe, which for convenience I call in English "Damson-Hop" Aphis; and it will be seen that in the above notes we have direct statements from trained entomologists of the Hop Aphis migrating from Sloe, and also of the *Malaheb* being only a variety of the *Humuli*.

I do not think we can trust to the observations of non-entomologists not conversant with minute distinctions of species, nor aided by powerful magnifiers, as to special cases of transference. Therefore, though with regret, I have not inserted several notes; but I certainly consider that the opinion of a large number of Hop-growers that the Fly comes to some amount on the wing from Sloe or Damson, backed up as it is by all the details above given, is a strong foundation for reasonable belief in the theory of migration.

The great difficulty as to whether the *Humuli* and *Malaheb* are to be considered distinct or not rests on how far such amount of greater development of the frontal protuberances as exists, or is considered to exist, in the *Humuli* may constitute it a distinct species. As far as I can venture to form an opinion, I join with those who think it does *not* amount to specific difference. And further, it appears to me that this marked development of the tubercles and root-joint of the horns which we see on the *Hop-lice* in various conditions in summer is an increase in development on the form that *they* bore in early spring, as well as on the form of the Damson-Hop lice.

From the latter part of March onward to about the time of the appearance of the Fly, I found that the Hop-lice had the frontal tubercles and enlarged root-joint, as figured at p. 48,‡ this sketch being a representation of large numbers sent me from infested Hop-plants,

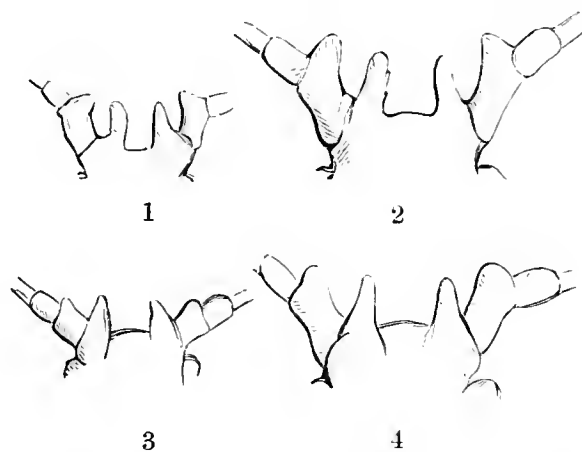
* 'Brit. Aphides,' G. B. Buckton, F.R.S., vol. i., pp. 168, 169.

† 'Eighth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois,' by Cyrus Thomas, Ph.D., p. 70.

‡ The examinations were made with inch and quarter-inch object-glasses, and, as mentioned before, with great care to remove all other Aphides besides those under consideration, and especially *Aphis Pruni*.

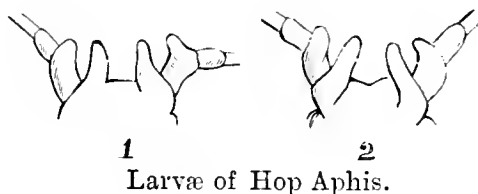
and I could detect no difference in form between the lice from Hop-plants and those from Sloe or Damson.

At the time of flight from the Sloes I figured the wingless females and pupæ (or larvæ containing young) from Hop-plants, and also from Damson or Sloe, and noticed a slightly greater amount of gibbousness in the root-joint of the antennæ of the Hop Aphis, but, as shown in the figures below, this difference was very slight. But, continuing



ADVANCED STAGE (? PUPÆ). WINGLESS FEMALES.
1, 2, Hop Aphis; 3, 4, Damson-Hop Aphis.

the observations after a time, I found a difference in amount of development of these frontals in some of these young Hop-lice, and, on being furnished with a supply in Hop-cones, on the 26th August, I found that the frontal tubercles and amount of gibbous form of the root-joint of the horns was more developed; in fact now (*that is, in the summer form*) they precisely resembled the typical figure of the head



1 2
Larvæ of Hop Aphis.

of the *Humuli* larva given by Mr. Buckton (fig. 1), which I copy for comparison with my own drawing (fig. 2, from a summer specimen).

From the observations—though I submit my views with great deference—I incline to think that the difficulties as to increased summer development of the Damson-Hop Aphis have arisen from observers not studying sufficiently the parallel state of the Hop Aphis at the same time.

Kaltenbach and Koch speak of it on Sloe in May and June; my own observations, both on Hop and on Sloe or Damson, began in March, and, according to what I consider the form then to be, the lice of *both Humuli and Malaheb then are not furnished with as full development as in the warm weather.*

If this be so, this appears to give the key to the difficulty, for, if *Humuli* differs as much from its own early condition as it does from *Malahab*—and this is the main reason for considering the two distinct—the reason is removed for the distinction.

It may be worth remembering that, from the minute size of the portion of the plant-lice under consideration, the shape of these growths cannot be distinguished at all without a good magnifier; consequently they are open to many opinions, but those who hold (as there appears to me good reason to do) that the Hop and Damson-Hop Aphides are mere varieties, and to be found alike on Hop-plants in summer, may support themselves on the opinion of good entomologists of Germany, England, and America, and the practical opinion of many of our own Hop-growers. Practically, as we need knowledge of where so much of the summer attack of Fly comes from as does not come from the Hop-plants themselves, the point is of importance.

With regard to prevention of attack, the experiments tried under the direction of Mr. A. Ward on various Hop-hills, and on the acre of Hop-land at Stoke Edith Park, near Hereford, of which the use was courteously given by the Lady Emily Foley, show that the first attack caused by lice deposited by wingless females coming up from the Hop-hills in spring may be prevented by various applications, of which the following details have been reported by Mr. Ward.

On the 9th of April Mr. Ward began to apply experimental dressings to Hop-hills as follows:—

4	roots	were dressed with	paraffin mixed with ashes.
4	„	„	lime.
3	„	„	salt.
4	„	„	salt and lime in equal quantities,

and besides these one hill, then, like the others only just showing the tip of the shoots at the surface, or barely above the ground, was covered in with muslin. The ground round these stocks had been watered with paraffin and water, and salt and water in the previous autumn after the bines were removed.

On the 3rd of May Mr. Ward forwarded information of the commencement of his operations on the experimental acre as follows:—

315	hills	were dressed with	paraffin and ashes.
128	„	„	paraffin and sawdust.
218	„	„	paraffin, sawdust, and ashes.
63	„	„	paraffin and shoddy.
160	„	„	salt and ashes.
63	„	„	lime.
63	„	„	soot.
63	„	„	gas-lime and soot.
189	„	„	gas-lime.

The ingredients in the various mixtures were used in the following proportions :—One quart of paraffin to one bushel of ashes, sawdust, or shoddy ; where sawdust and ashes were mixed, half a bushel of each to one quart of paraffin. Salt and ashes, one bushel of salt to eight bushels of ashes. Gas-lime and soot, equal parts.

The stocks were well-dressed, and the ground thoroughly covered with each kind of dressing.

Shoots were pulled off from one row (respectively) of the plants dressed with paraffin and ashes, with paraffin and sawdust and ashes, and with gas-lime. The stocks sent up strong shoots again through the paraffin dressings, but *not* through the gas-lime. On the 23rd of May these were weak and sickly, as were also the other two rows dressed with gas-lime.

Reports were forwarded at intervals, and up to the 26th of May the plants that were being experimented on remained *perfectly clean*, whereas those in other parts of the Hop-yard had been infested by wingless females and lice on the under side of the leaves. At the above date the Fly—that is, the winged Aphis—appeared, and attacked the plants that were being experimented on, as well as the others.

On this Mr. Ward justly remarks that it points to the dressings which had been applied having prevented attack *coming up from the ground* ; and, further, that he considers the plants isolated under muslin having kept clean up to that date (June 24th) was owing to the above-mentioned preventive waterings which he gave to the soil round the roots last autumn.

The effect of the dressings on the health of the plants was reported at intervals, and it proved that *gas-lime* was prejudicial,—one row dressed with this was dead on August 21st. Salt, and salt and lime mixed, were injurious to some degree to the plants, but the other dressings answered well ; and at the above date, with the exceptions mentioned, *all* the experimental plants looked well and were bearing well.

It is important to observe that of the plants under experiment upwards of 700 *were dressed with paraffin* applied in ashes, or in some material by means of which it could be spread on the surface of the hills, and that the plants so dressed were reported throughout as doing well.

During the last few years the serviceableness of mineral oils as insecticides, when so *combined* with soft-soap and water that they may be diluted further as may be needed for use *without risk of the oil and water separating again*, has been brought forward both in this country and also under the direction of the Department of Agriculture of the United States.

I think, however, our own method of application is the safest for the plant.

The U.S.A. plan is to add one gallon of water, in which a quarter of a pound of soft-soap (or any other coarse soap preferred) has been well dissolved, boiling or hot, to two gallons of petroleum or other mineral oil. The mixture is then churned, as it were, together by means of a spray-nozzled syringe, or double-action pump, for ten minutes, by means of which the oil, soap, and water are so thoroughly combined that the mixture settles down into a cream-like consistency, and does not, if the operation has been properly performed, separate again. This is used diluted with some three or four times its bulk of water for a watering; if required for a wash, at least nine times its bulk is needed,—that is, three gallons of “Emulsion,” as it is termed, make thirty gallons of wash. Warning is given that care must be taken with each new crop to ascertain the strength that can be borne by the leafage; this of course varies with the age of the leaves, as well as the nature of the crop.

In my own experiments with this mixture I increased the quantity of soft-soap, and for Hop-plants I should consider it would be desirable to *double* the proportion of soft-soap and *lessen* that of the paraffin to at least a sixth.

An addition of some amount of paraffin to soft-soap wash has been shown to be serviceable by the experiments of Mr. Ward at Stoke Edith in 1883, and in the last season. The proportions used by him for large quantities are 12 lbs. of soft-soap and half a gallon of paraffin to 100 gallons of hot water, the mixture stirred well together and used when cool; the nearer boiling that the water is used the better the paraffin mixes. This wash is found to be very effective in killing the Aphides without injuring the plant or the burr.

Quassia has answered well in several localities as an addition to the common soft-soap wash. The Hop-bines which I examined personally in the neighbourhood of Barming in the early summer looked very clean and well after this application. The proportion used was 6 lbs. of quassia and 3 lbs. of soft-soap to 100 gallons of water.

At Rodmersham, Sittingbourne, the proportion used is mentioned by Mr. M. Mercer, Jun., as 4 lbs. of quassia and 8 lbs. of soft-soap to 120 gallons of water; sometimes equal weights of quassia and soft-soap are used to the above quantity of water, but the first solution is recommended as good.

Mr. Walter Arnold, of Frant, Tunbridge Wells, writes:—“With regard to the quantities of soap and quassia used and method of mixing, we use 1 lb. soft-soap (best procurable) to 12 gallons of water, and 1 lb. quassia to 10 gallons of water—making 22 gallons wash. We use steam from the engine for boiling the quassia and dissolving

the soap. We, however, first steep the quassia in cold water, as it is said the properties are extracted better by cold than hot water, as the heat tends to expand the wood, thus preventing the water penetrating into the chips. But we find we get a very strong extract from chips which have been previously steeped in cold water by very rapidly steaming for a couple of hours."

Taking the measure of water at 100 gallons for the sake of comparing proportions, the above quantities give from about 3 lbs. to 6 lbs. of quassia and from 3 lbs. to $4\frac{3}{4}$ lbs. of soft-soap as the proportions used. Conjecturally the great difference in amount of quassia may arise from different methods of preparing the infusion.

The remaining point of practical interest which has been brought forward relatively to the treatment of Hop blight during the past season is the introduction of washing by steam-power. Through the courtesy of Mr. Levett, and Mr. Walter Arnold, of Frant, near Tunbridge Wells, the inventors of the process, I have been furnished with details of the method of operation, of which the following is an abstract:—

The steam apparatus consists of a pump driven by a steam-engine, which pumps the water from a stream or reservoir into a large tub. From this another pump forces the water (to which the soft-soap, &c., has been added) along a one-inch iron gas-pipe. This pipe is laid between the rows of Hops, and is furnished (at intervals of sixty feet) with taps and unions, to which lengths of 180 ft. of india-rubber tubing are attached. To the end of these tubes smaller tubing is fixed, so that each 180 ft. tube is supplied with two free ends, which are furnished with nozzles, and worked in the usual way by men or boys. The amount that can be washed per day by ten jets with this apparatus is reported at $7\frac{1}{2}$ acres, and the cost per acre to be somewhat less than six shillings.

As yet the plan has only been tried on a limited extent of ground, but so far it is reported to be successful. Should it prove so on more extended trial the large amount of acreage which can thus be washed per day will be a great recommendation, and, where water supply is available, the method of operation appears capable of being adapted to field use for the prevention of such other insect-attacks as we know to be checked by sudden and violent rain.

The main points shown by the observations of the season appear to be that first attack was found as early as March coming up from the Hop-hills in the form of wingless females with lice, and that this was both confirmed on a broad scale and method of prevention shown by the circumstance of the acre of Hops which was dressed in spring with various applications (specified) to prevent attack remaining quite clean (though the rest of the garden was attacked), until the "Fly"

—that is, winged *Aphis*—appeared. Also, there does not appear to me to be any reason to doubt that the Hop and Damson-Hop *Aphis* are merely slight varieties of one species, a remark which scarcely occupies a couple of lines, but which required constant examination of parallel condition of the two sorts from March to September, and which (if correct) lies at the root of the most important measures for prevention, save those above mentioned.

Amongst measures of remedy, dressings with paraffin in any dry material, by which it can be spread on the hills in spring, have been shown to be useful, and so has the addition of quassia to the washings; whilst amongst methods of washing, the application of the steam-power to this purpose opens up a possibility of carrying these operations on with a greater rapidity and less cost, of which the further proofs will be looked for with interest.

I should also add my thanks to the many correspondents through whose courtesy and likewise painstaking search I have been furnished with observations and specimens from which the above notes have mainly been taken.

Fever Fly.* *Dilophus vulgaris*, Meigen; *D. febrilis*, Linn.



DILOPHUS VULGARIS.

Female Fly, magnified and nat. size, flying round Hop-cones.

At the beginning of April specimens of larvæ were forwarded to me from Mr. Faunce de Laune, of Sharsted Court, Sittingbourne, with the information that they were found in a piece of Hop-root sent accompanying, and appeared to be feeding on it, and that the same kind of grubs were then rather numerous in the Hop-hills. The piece of Hop was partly decayed, and, on cleaning it to gain a sight of the

* As this Fly appears to be without an English name, I have retained the original one given by Linnaeus from the Fly being supposed to occur in the rooms of fever patients.

state of surface, it appeared freshly injured, as if the grubs were feeding *on it*,—that is, on the live part, not merely on the decayed matter outside.

A few days later it was reported from Sharsted that, “ These grubs appear to be doing much damage to the Hop plants by gnawing away the original plant, and considerable quantities of them may be found even at one stem.”

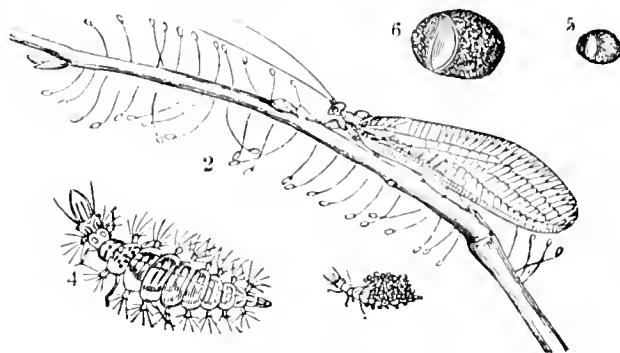
These little grubs were only about a quarter of an inch in length, and like small Daddy Longlegs grubs in shape—that is, cylindrical and legless—but more prickly, and with the head brown or chestnut-coloured. These were plainly Tipulide grubs, and about three weeks later a further supply was sent, of which some were then gone on to the chrysalis stage—whitish, and which (like the Tipulide or Daddy Longlegs chrysalids) showed the shape of the insect forming within.

The flies began to develop about the middle of May, and proved (when submitted for examination to Mr. R. H. Meade) to be the *Dilophus vulgaris*, Meigen, a small two-winged Fly (for size and shape see figure), of which the males are intensely black; the females have the abdomen brown, and the wings brown or blackish. A second brood appears in autumn.

This Fly sometimes appears in vast swarms, and in the most various kinds of places. It will be remembered as appearing amongst the Hop-cones at Rainham, in Kent, in 1882; it has been observed in enormous numbers off the Norfolk coast: in 1862 it was recorded as hanging in millions on flowers and in bunches on grasses.

The amount of damage that it may cause is worth watching, for, as far as we see at present, it is one of the instances in which the grubs are double-feeders. They are considered to *live upon the roots of plants*, particularly of grass and corn. John Curtis, in his ‘Farm Insects,’ p. 467, notices this same species of *Dilophus*, then known as *febrilis*, Linn., as “ exceedingly abundant every year, and the larvæ causing much damage in the gardens”; but also the grubs are to be found both in horse and cow manure, and were noted by Curtis as found in considerable quantity in “ a vine border amongst the horse muck ” (‘ Gard. Chron.’ 1844).

Looking at these various points together it seems very likely that the flies lay their eggs in the manure, and thus the grubs are introduced to the roots of the plants; and if, on further investigation, the damage done to the roots prove important, it is this point (the presence of the grub in manure) which will be the one to look to first.

Lace-wings (larvæ, APHIS-LIONS). *Hemerobiidæ*.

CHRYSOPA PERLA.

Golden Eye, and stalked eggs. Larva and empty cocoon, nat. size and mag.

On August 9th I received specimens of stalked eggs from Mr. James Knight, of Hillash, near Petersfield, with enquiries as to the nature of the insect that would develop from them, the eggs "having been found suspended by a filament to the under side of a Hop leaf."

These stalked eggs (of which one kind is figured) belong to the *Hemerobiidæ*, or "Lace-wings," a family of flies of which the larvæ feed chiefly on Aphides, whence their grubs take the name of "Aphis-Lions." As these Lace-wings are of use as checks on different kinds of Aphis, and are quite large enough to be seen and destroyed if their nature is not known, the following short account of them is given, with the special observation that *they rank, like the Ladybirds, amongst beneficial insects.*

The *Hemerobiidæ*, or Lace-wings, are divided by Stephens into four genera, of which the *Chrysopa*, or Golden Eyes, and the *Hemerobius* are the most important. The figure shows one of the common kinds, the *Chrysopa perla*. This is of a yellowish green, with "golden eyes," and has long horns, and rather long and narrowish iridescent wings, which are much marked, especially down the central part, with net- or lace-like veins. These wings are turned down when at rest (see figure).

The division may be known from the *Hemerobius* by the latter having shorter horns, smaller eyes, and the wings being shorter and broader, and somewhat downy, with fewer cross-veins.

The habits of these appear much alike. The female discharges a small quantity of sticky matter together with each egg. This is drawn out in the operation of egg-laying into a long fine thread, which hardens rapidly, and thus bears the egg safely, like the head of a small pin, on the top of the slender egg-stalk.

The eggs are laid on twigs, or trunks of trees, or leaves, or anywhere apparently where Aphides which the grub will feed on, are to be found. These Aphis-Lion grubs or maggots are generally much

alike in shape—that is, long and narrowish ; sometimes, as with the kind of Golden Eye figured, have tubercles along the sides furnished with bunches of hairs, which serve to support a kind of cloak formed of the skins of the Aphides the maggot has killed. The grubs are active, and wander about where their food is plentiful, and by means of their long jaws soon demolish any Aphis they attack ; it is stated that half a minute is enough for them to suck out the contents of the largest Aphis, but they will also attack and destroy good-sized caterpillars, and, if no more suitable food occurs, will try their jaws on each other.

When full-fed, which is stated to be in about a fortnight, the larva spins a cocoon. These cocoons “ vary from the size of pearl barley to that of a small pea, and are attached to the leaves of plants, &c. ; in these they change to pupa, and in about three weeks the flies come forth in summer ; but the autumnal ones remain through the winter in the torpid state.”—Curtis’s ‘Farm Insects,’ p. 78.

One species is known as the Hop Lace-wing, the *Hemerobius Humuli* : this is less than half the size of the Golden Eye (figured) in the expanse of its wings. The colour is pale ochreous, with bluish eyes, two faint rows of spots along the upper side of the abdomen, and the wings are also marked with dusky spots. Amongst the vast number of insect-plagues to the Hops it may be of service to know this insect as a friend, if it should be noticed in large numbers.*

MANGOLD.

Beet-Carrion Beetle. *Silpha opaca*, Linn.

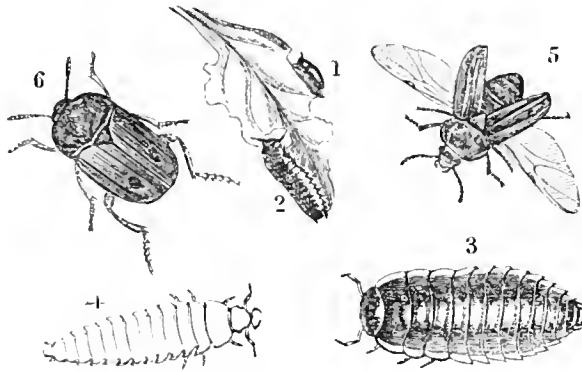
Through the courtesy of the Editor of the ‘Farmer’s Gazette.’ Dublin, I have been favoured with the following note of the appearance of the Beet-Carrion Beetle, an unusual kind of attack in this country.

The observer, having noticed that something was eating his Mangolds at Mageney, County Kildare, examined closely, and found the damage was caused by insects, of which he forwarded specimens, *this kind of attack not having been previously noticed by him*. The fly-maggot of the Mangold had been more or less prevalent for four years, but in the present instance, though some of the plants had been only partly

* As I am only partially acquainted with the habits of the Lace-wings from personal observation, the above description is mainly given from comparison of the published accounts of John Curtis, F. Stephens, and Prof. J. O. Westwood.

eaten by the insects, the greater number had been wholly eaten away, *excepting the stems of the leaves.*

The specimens forwarded proved to be of the Beet-Carrion Beetle, the *Silpha opaca*, Linn., the grubs of which have been recorded as doing great harm in France to Beet or Mangolds; and injury was caused many years ago to Mangolds in Londonderry and Tyrone, by the grub



SILPHA OPACA.

1 and 2, young and full-grown larva; 3 and 4, larva, magnified; 5, female beetle flying; 6, male beetle, slightly magnified.

either of this beetle or one of the same nature indistinguishable from it. But, though this species (*S. opaca*) is common in England, it has not yet, as far as I am aware, been observed here as a crop-pest, and up to 1859 was stated by John Curtis "to be unknown on this side the water as an enemy to agriculturists."

This beetle takes its double name from the circumstance that its grub will feed on Beet or Mangold leaves, as well as on putrid animal matter, as dead animals, garbage, and the like, in which the beetle is commonly found.*

At present it seems uncertain how many species or varieties of these "Carrion" Beetles (*Silphas*) feed at times in the grub-state on Mangold-Beet leafage. There are certainly two kinds that do so: the brownish and somewhat downy *S. opaca*, Linn. (figured), and the black shiny species, the *S. atrata*, Linn. The grubs of the Beet-Carrion Beetle (also figured) are, when full-grown, much the shape of wood-lice, and furnished with horny jaws and three pairs of short-

* *Silpha opaca* of Linnæus, *S. tomentosa* of DeGeer (see Curtis's 'Farm Insects,' p. 392. The local varieties of the *S. atrata*, L., are given as *cassidea*, Dahl., in the Banat; *jusca*, Herbst, in Germany; *pedemontana*, Fab., in Italy; *punctata*, Herbst, Alps; *subrotundata*, Steph., in England (see Calwer's 'Kaferbuch,' p. 97). In 'Handbook of Beetles of Great Britain and Ireland,' by H. E. Cox, vol. i., pp. 409, 410, I find the *S. subrotundata* above mentioned given as a variety of *S. atrata*, and thus, pursuing the subject, get round to this kind and variety being the same as the *Phosphuga atrata* and *P. subrotundata* of Stephens, of which that writer says the former "hibernate beneath mosses, dead leaves, and stones, and are often plentiful in summer on sand-hills near Swansea; and the second is rare in Britain, but more abundant in Ireland."

jointed legs, and of a shiny black colour, sometimes tawny or yellowish at the edge. They feed on the young leaves of the Mangolds, sometimes clearing away the plants entirely just when the first leaves are coming up; from about the beginning to the middle of July appears the time for them to turn to chrysalids. The grubs then go down about three or four inches deep into the ground, from which the beetles begin to appear in about three weeks.

The perfect beetles may be found during winter or early in the spring sheltering under stones, or in the moss or rotten wood, or clods, &c., and are common in April in dead animals.

Where the eggs are laid from which the grubs hatch that attack the Mangolds does not appear to have been recorded. It may be under decaying matter in the field,—the *S. atrata* has been found to lay eggs “in decaying leaves, or just at the surface of the ground”; but, looking at the nature of the beetle, it seems much more likely it should be in some specially rank kind of manure, and the eggs thus be brought, or the beetles thus attracted, to the field; offal and sea-weed, or shore-refuse, are special points to be looked to, and likewise the possibility of the beetles being brought amongst decayed leaves, in which they winter.

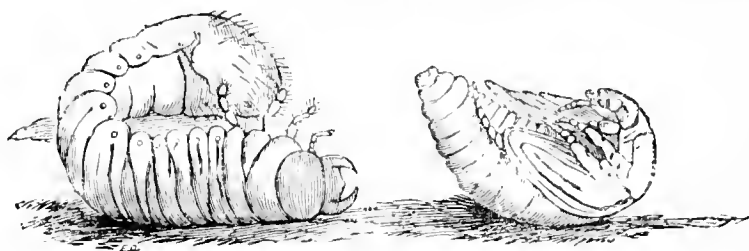
With regard to remedy when attack is present, nothing appears to have been observed, excepting that lime and salt have both failed to be useful; but it is very likely that dressings of paraffin mixed in dry earth or ashes, or the mixture of gas-lime, sulphur, &c., recommended some years ago by Mr. Fisher Hobbs as a Turnip Fly preventive, would either of them be of service, if sprinkled when the dew was on, or on a damp day, so as to adhere to the leafage. The proportions are as follows:—One bushel of gas-lime, one bushel of lime fresh from the kiln, six pounds of sulphur, and ten pounds of soot, well mixed and powdered. To be applied early in the morning. The above is enough for two acres, and a broadcast machine is recommended as an expeditious way of spreading it.

The attack is not noted as affecting other kinds of root or “vegetable” crops. Turnips, Carrots, Potatoes, Parsnips; likewise Peas, Beans, and Cabbage are mentioned as succeeding admirably on land where Mangolds were destroyed. Therefore, if the Mangold is swept off (as sometimes happens) *in the seed-leaves*, another kind of crop could be put in *immediately*, which gets over a very frequent difficulty as to a crop-pest in possession taking everything that may be put in to the infested land. If, however, the crop has *any life* left in it, it seems best with this special kind of attack to let it stand, for the grubs only eat for a moderate length of time, and during the hull, whilst they are going through their changes in the ground, there is time for the centres of the plants to push up again and grow past danger.

This attack, if it occurs at all, is apt to be very severe, but it is so unusual that it would be well worth while to direct attention to investigating what has caused its appearance.

It has been conjectured that the eggs of the beetle may be brought in seed, but in this case it is much more likely to be in foreign than in home-grown samples.

Cockchafers. *Melolontha vulgaris*, Stephens.



MELOLONTHA VULGARIS.

Larva and pupa of Cockchafer.

On May 20th some Cockchafer grubs were forwarded to me from Smethwick, near Birmingham, which had been found *twelve* inches below the surface in garden ground, on land which had been part of an old pasture broken up the preceding year; and later in the season another specimen was sent from near Chesterfield from the bottom of a *five*-inch furrow. This was from a field that was being ploughed after having been two years in seeds.

These notes show the reason of one of the great difficulties in getting rid of Cockchafer grubs in field cultivation, namely, that they are very likely to be below the level at which they will be turned up by the plough.

The Cockchafer beetles and their injury to the leafage of many kinds of trees is well known; but, from the fact of the grubs feeding entirely underground, many people are not in the least acquainted either with their appearance or habits. These grubs feed voraciously on the roots of meadow-grass, of trees of various kinds, not excepting Fir, and they are also injurious to root-crops, as Potatoes or Mangolds, &c., if these are put into ground infested by these long-lived grubs. The eggs are laid some six inches or so below the surface of the ground, and the grubs come to within a short distance of the surface to feed; but go very deep down, far below ploughing depth, in winter, and it is not until their fifth year that they develop to the perfect beetle.

The above sketch gives a figure of the Cockchafer grub when full-grown, showing its large head, with strong horny jaws, and the three pairs of jointed legs. The colour is white, with head, jaws, and legs

of a yellow or rusty colour. The end of the tail is bluish, from the digested food showing through the skin, and is somewhat enlarged so as to have a swollen appearance. The chrysalis or pupa is like the perfect beetle, with the forming limbs folded below it.

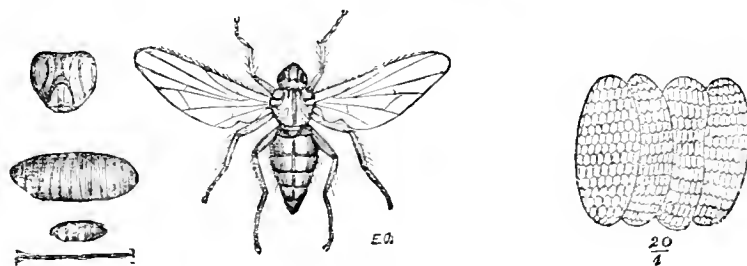
The Cockchafer in England, and various kinds of Chafer in Canada, Ceylon, and other parts of the British possessions, are so destructive in their grub-state that any information of practical methods of keeping them in check would be very serviceable.

With regard to the powers of destruction of an individual grub, I found by experiment that one about three-quarters grown, placed with an uninjured Mangold root, had by the following morning gnawed a hole half an inch across and three-eighths deep; by the following morning it was large enough for the grub to lie in; and on the next day the burrow had been so far extended under the rind that the grub was out of sight, having thus cleared out a burrow about an inch and a quarter or more in length, and half an inch across in about three days.

From experiment made with a mixture of mineral oil (kerosine) and soft-soap, it was plain the grub could go down into the ground quite fast enough to avoid any harm even from this strong insecticide. Shaking down the beetles from trees on to cloths and destroying them, or shaking them down to pigs, gets rid of great numbers; but with regard to the grubs, no way seems practicable—or at least known of—for getting rid of them, excepting disturbing the infested surface of the ground, *when the grub is near the top*, and having these grubs hand-picked or killed by droves of pigs; or sometimes, amongst tree-roots, turning over the surface with stout wooden pegs and clearing the grubs, answers well.

More information is greatly needed.

Mangold and Beet Fly. *Anthomyia Betæ*, Curtis.



ANTHOMYIA BETÆ.

Beet Fly and pupa, mag. and nat. size; head and eggs, mag.

On the 26th of August I was favoured with the following communication from Mr. Watson Hornsby, of Abbey Town, Holme

Cultram, Cumberland, which I wish particularly to draw attention to, as, in addition to valuable notes on cultivation, it gives reliable information as to the appearance of the Mangold maggot as a crop-pest, having been noticed in Cumberland several years before the date at which it was generally observed. Mr. Hornsby writes :—

“Acting on the permission kindly given in last week’s ‘Agricultural Gazette,’ I venture, as a Mangold grower of some experience, to trouble you with a few remarks on the above.

“I observe in your notes that you speak of 1880 as being the year, ‘so far as you are aware,’ when the *Anthomyia Beta* was first observed as a crop injurer. It would appear, however, that the insect has proved itself a pest to Mangold growers in Cumberland several years previous to the one you name. In 1876 the Mangolds on the farm I then occupied were much injured by it, but this was the first year that I had noticed the maggots in the leaves, although for some years previous to that the leaves of the young Mangold plants had presented, at certain stages of their growth, that shrivelled-up appearance which is a sure sign of the attack of the maggot; and I have no doubt now that it was so, though at that time the injury was ascribed to other causes, frosts, &c. The attacks, however, were *not very severe or general until 1876*, since which the Mangolds have suffered heavily every summer; so much so, indeed, that in many districts they have been dropped out of cultivation in a great measure, only a few patches being grown in situations peculiarly adapted to their growth. The attacks usually take place during the first two or three weeks in June, and again about the beginning of August; the second attack, however, does not do much injury generally; indeed, if the Mangolds are flourishing and inclined to get much leaf, I have sometimes thought the second attack did them good by ridding the plants of some of their leaves and letting in the air and sun to the roots,—at all events, I have known the roots thrive very rapidly afterwards. The first attack, however, is often nearly fatal to the crop.

“I have noticed a somewhat curious fact in connection with the attack of Mangold Fly, and that is, that on the east side of a north and south fence the Mangolds for a considerable distance are nearly clear of attack, although in the middle and east side of the field the maggot may be very numerous, and the higher the fence the more shelter it seems to afford from the attack. I cannot say that I can altogether account for this, but probably you may be able to throw some light on the question.

“With reference to prevention and remedial measures, I should recommend *good cultivation, autumn if possible, a free use of fertilisers, and I consider a liberal application of salt or potash, salt, or both, to the land intended for Mangolds as a sine qua non in Mangold growing.*

Treatment of the foregoing kind will, I think, prove the best preventive. I have tried dusting of several kinds on the plant, but without perceiving any benefit; but a good drenching of paraffin and water I have known undoubted good results from. The difficulty is in applying the latter, as the mixture requires constant and quick stirring during application, or the paraffin will come off by itself."

Mr. Jabez Turner, Norman Cross, Peterborough, also favoured me with the following note on autumn cultivation:—"I am still in favour of *autumn manuring* for Mangold,—in fact, on strong land I do not think the land should be worked in the spring, except with a horse-hoe. This will in most cases give sufficient tilth, and the condition of the manured soil will force the plant beyond the attack of the Fly."

On the 17th of June Mr. D. Byrd, writing from Spurstow Hall, Tarporley, Cheshire, mentioned:—"Our crops of Mangolds are very badly affected; we have not done anything to them this year, and the only manure used is farmyard manure of a richer quality than is usual."

A number of the Mangold leaves were enclosed for inspection with regard to minute objects found on the back of many in the field. These proved to be the white oval or spindle-shaped eggs of the Mangold Fly, with the reticulated surface, as shown in the figure.

The eggs in many cases had hatched, and were mere empty films, the maggot having made its way into the substance of the leaf by boring a round hole into the skin, through which it had gone, dragging part of the egg-shell with it into its passage.

Many of the leaves were already blistered by the maggots working within. On Nov. 8th Mr. Byrd mentioned "that the same kind of eggs were to be found late in the summer under the largest leaves without causing any perceptible injury to the Mangold";* and further observed that, considering the very dry season, his root-crops were fully equal to those of former years, although he did not use guano or artificial manure to stimulate growth, but depended entirely on farm manure; and remarked:—"We feed our cattle liberally with cake and corn, which give rich manure; and we also use dry soil to absorb the liquid manure, and fix the ammonia, making the whole more valuable."

The above note seems to me to point still in the same direction as the others, namely, that good cultivation and rich strong manuring, such as that noted, carries the crop through attack, but that, whether farm manure attracts the Fly or not, the attack is sometimes to be found badly where only farm manure is used.

* This is in part because the old plants with large leafage suffer less from attack, and probably in part because the maggots are not able to bore through the skin of the leaf so readily as earlier in the year.

With regard to methods by which paraffin may be applied as a wash without the difficulty occurring that is mentioned on p. 61 of the paraffin and water separating, the reader is referred to the U.S.A. plan, mentioned at p. 54 under Hop Aphid, by which paraffin or other mineral oils may be so thoroughly combined with soft-soap and water that the mixture can be further diluted with water to the strength needed without separating again. As far as my own experiments go the method of mixing answers, but the strength that is safe to use of course requires experiment.

The following recipe, however, for a simple and effective method of making a mineral oil solution is the best that I have met with. The proportions and plan of mixing were worked into this practical form by the late Mr. Alex. Shearer, while at Yester, Haddingtonshire, who was a clever chemist as well as an able and intelligent gardener. The method has now been tried for some years, and found safe as well as serviceable, and is in regular use under the superintendence of Mr. Malcolm Dunn in the Gardens of the Duke of Buccleuch at Dalkeith Palace :—"To eight parts of soft water add one part of black (soft) soap, and boil briskly for a few minutes until the soap is thoroughly dissolved. While boiling add paraffin, or any similar mineral oil, and boil for a minute or two longer, when the whole will be thoroughly amalgamated,* and, if bottled and securely corked while warm, it will remain so, and be fit for use at any time when required. The strength of the solution of course depends on the amount of mineral oil in it, and it can be easily reduced to the proper power by mixing it with soft water as it is wanted for use."

Mr. Malcolm Dunn gives me the following notes as to the method he finds most convenient for mixing the application :—"In practice I boil the proper proportions of soap and water together, and when ready I fill this into ordinary wine-bottles, which have been placed in boiling water. The bottles are about half-filled with the lye, and then the paraffin is poured into them, *two gills* being put into each bottle. The bottles are then filled up with the boiling lye, corked at once, and stored away for use.

"When required for use a bottle of the mixture is poured into a four-gallon watering-pot, which is filled up with soft water, and is ready for use, at a strength of one wine-glass of paraffin (*half a gill*) to one gallon of water."

Mr. Dunn further notes that the important point is the proportion of the soap and water :—"Eight parts water and one part soft-soap thoroughly amalgamated form the lye which takes mineral oil, and

* For field use the immediate application would save all need of storing. For garden use the arrangement of bottling saves much risk from careless workers, as the exact amount to be used can be given out.

thoroughly amalgamates with whatever proportion of this may be added,—that is to say, the paraffin may be put into the boiling soap and water in any quantity, and the whole will mix together of an equal strength throughout. Heat helps much in quickly producing thorough amalgamation of all the ingredients, and hence I have stated that they should be mixed in a *boiling state*.

“ My object in using common wine-bottles for mixing the lye and paraffin is, for one thing, they cost me nothing, and the cost is not heavy in any case ; but further, by having two gills (four wine-glasses) of paraffin in each bottle the men can make no mistake in using it at the proper strength. By using one bottle of the mixture (containing four wine-glasses of paraffin) in an ordinary four-gallon can, the mixture is at the rate of one wine-glass of paraffin to a gallon of water, and so on.

“ Few plants in a *green state* will stand a strength of four wine-glasses (two gills) *to the gallon*, but at the same time *it is not necessary to use it so strong for even Scale insects*, the most difficult to kill of all ordinary plant-pests.

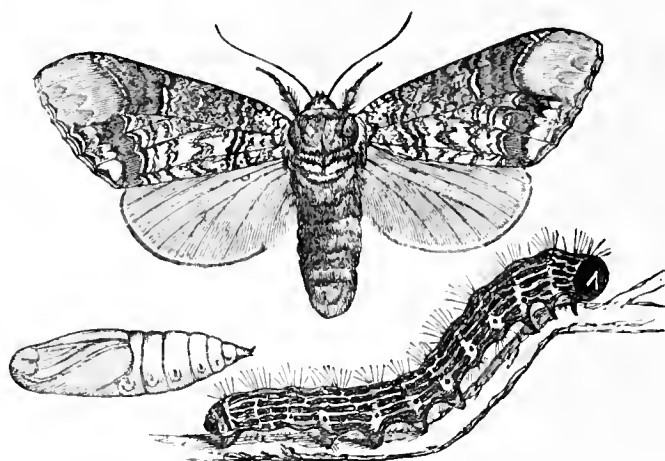
“ One wine-glass full of paraffin to a gallon of water is strong enough to kill Aphides, and such soft insects ; two wine-glasses for Thrips, and three wine-glasses for Scale is our ‘ regulation ’ strength. The tender young fronds of ferns and the *young green growths of most plants will not be safe if over one wine-glass to the gallon is used*.

“ This mixture is such a safe, cheap, and easily applied remedy for insect-attack that a knowledge of it must prove a boon to many who have their crops annually destroyed by insects.”

The above recipe, which has now been in use with success for some years, will probably be of service for a large number of attacks on bush-fruit trees (as for Gooseberry caterpillars, &c.), and (at least in garden cultivation) for Aphides on Cabbage, Carrots, Turnips, &c. ; but I place it under the heading of Mangolds, as this is one of the regular field-crops to which paraffin solution has been successfully applied in the case of leaf-maggot, and would have been more used but for the difficulty of keeping the paraffin permanently mixed.

O A K.

Buff-tip Moth. *Pygæra bucephala*, Stephens.



PYGÆRA BUCEPHALA.

Buff Tip Moth, caterpillar, and chrysalis.

The caterpillars of the Buff-tip feed on the leafage of various forest trees, as Elm, Oak, Lime, &c., and sometimes are found on fruit trees.

On the 19th of August Mr. Angus M'Intosh forwarded specimens of this kind of caterpillar, then about three-quarters grown, from Llanerch, Llanelly, South Wales, with the note that they had been found the previous day attacking young Oaks in the nursery. Mr. M'Intosh observes:—"They had, when I noticed them, entirely stripped two or three young trees of their leaves, and then were clustered together on the twigs in much the same way as the Pine Sawfly caterpillars on Scotch Fir, and were doing their work quite as thoroughly. They are very voracious. I tried soapsuds on them, and I think from the results it is just the thing to destroy them with; it sticks into their hairy coats so effectually."

Further on Mr. M'Intosh reported that he had destroyed the companies on the young Oaks, and noticed the habit these caterpillars have of falling to the ground when disturbed.

When young these Buff-tip caterpillars are gregarious; they feed together in parties, and (*vide* Newman's 'British Moths') "are readily found by the devastation they cause. Each brood fixes on some top-most outside branch of Elm, Lime, Hazel, or other tree, for this species appears a very general feeder, and, completely stripping off the foliage, leaves the twigs as bare as in the depth of winter."

When the caterpillars are out of reach, a sudden jar, such as is given by throwing sticks at the infested boughs, will make them fall in great numbers, and, when once down, trampling on the fallen grubs

and putting a tarred band round the base of the trunks of the forest trees, so that they could not make their way back again, would be a thorough cure. For young trees in nurseries Mr. M'Intosh suggests that some sticky fluid or mixture [? Davidson's composition, Ed.] would be of great service.

The caterpillars are somewhat downy, yellow or tawny, marked with black lines, or long black spots interrupted at the joints, so as to give the appearance of upright orange streaks at intervals, and have black heads. They come to their full size, which is an inch and three-quarters long (see figure), from August to September, and then come down from the tree and change to brown chrysalids either on the ground or amongst roots or rubbish just at the surface. The moths from these come out in the following June, and are large and prettily marked. The head and fore part of the body between the wings is yellow, and the abdomen mostly pale yellow. It has the fore wings of a silvery grey, with various markings of black and rusty colour mostly placed in single or double lines, and with a yellow or ochrey patch at the tip, whence the name of the moth. The lower wings are whitish. The eggs are laid early in June or July.

I have seen the caterpillars do great damage in the neighbourhood of Isleworth, and the attack appears to be just one of those which may be very often got rid of by a little trouble, but which will be likely to do a great deal of mischief if not attended to. Shaking down the caterpillars and killing them when fallen, together with such measures as will keep them from crawling up the tree again, will get rid of a great many; and soft-soap washes (for various kinds of which see Index) would be of great use in clearing them off low trees or in nurseries.

ONIONS.

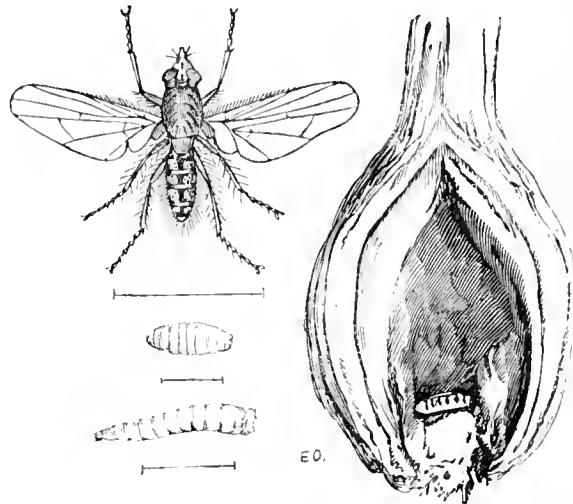
Onion Fly. *Anthomyia ceparum*, Curtis.

During the two seasons previous to 1884 I experimented on the effect of covering Onion bulbs up to the neck (or rather higher) with earth, so that the Fly could not get at the bulb to lay its eggs; and, on the small scale on which I was able to work the plan, I found it answer so well that during last season (1884) I again tried the plan of burying the Onions, but on a more definite method, and met with great success.

The principle of the arrangement was, that as the flies usually laid their eggs on the bulb itself (especially the lower part, and beneath

it if exposed), by burying the bulb safely away, so that the flies could not get at it, we preserved it from attack. The flies *must* lay their eggs somewhere, and if they cannot get at the right place (for them) to lay them in, the eggs must be dropped where they either will not hatch or the maggots will perish. I have found the eggs in such cases laid too far up the leafage of the Onions to do any mischief, or merely dropped on the ground.

On Jan. 25th, 1884, I had a trench dug as if for Celery, and in this, good manure was laid and covered over with a few inches of earth.



ANTHOMYIA CEPARUM.

Onion Fly, maggot, and pupa; magnified. Pupa in stored Onion.
Lines showing nat. size.

At the usual time in the spring I sowed Onions along the trench, disturbing the soil as little as possible, and also sowed Onions in the bed alongside. As the plants grew I had the earth from the sides of the trench gradually worked down upon them, which kept the bulbs fairly buried throughout the season, and also kept down the weeds. The row of Onions next the trench was also kept more or less covered, as the earth lay conveniently for spreading over the bulbs.

The Onions in the trench thrived remarkably well; those by them did well, but not so markedly; and on Sept. 10th, when the crop was raised, those from the trench gave a yield of sound and good bulbs, many of them very fine, and throughout the season there had been scarcely any attack of Onion Fly on these. This plan of growing in trenches could not be carried on easily on a large scale, but it has succeeded so well that this season I purpose growing my crop this way; and it appears to me that in many cases it would answer well to have the beds slightly ridged for Onion growing. The ridged earth can readily be worked on to the bulbs, and, besides direct protection from fly-attack, which (as far as I can see from three years' experiment) is afforded, much good is done by the weeds amongst the Onions being smothered

by the successive earthings; as, instead of the bulbs being thrown loose in the ground and exposed by the operation of weeding, they are more firmly fixed. With regard to the effect on the plant-growth in this way, all the root-fibres were preserved, which are often much knocked about in hoeing, and also the surface at root-level was kept from being dried in the hot sunshine, and the result was all that could be wished in quality of bulb.

PARSLEY.

Parsley "blight." (? caused by insect-attack or fungus).

On the 1st of November, Mr. W. W. Glenny forwarded some roots of Parsley from Barking, with the observation the crop had failed, as Parsley had never done on that farm before, and drew my attention to the appearance of "rust" on the roots, with the enquiry whether the injury was of insect origin. He further noted:—

"This Parsley was sown early in March and germinated freely; the crop flourished, and was hoed over twice, and in June some plants were thinned out and bunched for market. Dry weather set in, and the crop began to fail, *the leaves becoming parched or seared*, the mischief being charged to the excessive drought.

"This was difficult to comprehend, as the soil was in good condition and of a cool character; showers followed at intervals, with no improvement in the foliage, and in the middle of November the Parsley was still suffering.

"Similar dying off has been often noticed in the winter and attributed to dampness, but Parsley has not been so affected in the summer in this district."

A similar failure was observable in field-grown Parsley near Isleworth, and likewise in my own garden the leaves (as Mr. Glenny describes them) became yellow and sear, and the plant perished. On examining the roots I found patches on them where the bark was injured and decayed or "rusty," but on repeated and careful examination I did not find any "rust grubs" present such as produce the well-known disease caused by the larvæ of the "Rust" Fly, *Psila Rosæ*, in Carrots and Parsnips; and on consultation it appeared likely that this troublesome disease was of a fungoid nature, very probably caused by *Peronospora*, allied to what is commonly known as Potato disease.

It is mentioned by Mr. Worthington G. Smith that the *Peronospora nivea*, Ung. (*P. umbelliferarum*, Casp.), affects various umbelliferous

plants, but is especially formidable in its attacks on garden Parsnips. "Like other species of *Peronospora* it causes putrescence in the plants it attacks, and sets up decay in the leaves, stem, and roots. . . . In the Parsnip the large fleshy esculent roots become spotted, and at length putrid," &c.*

In roots I examined the spotty condition was very marked, also the end of the root was often rotted away; and Mr. Glenney's note connects the disease with Parsnip presence being previously on the ground. He says:—"Brown streaks or marks may be seen on the roots, and, as the crop followed Parsnips, *which had suffered severely from rust or canker*, it is probable that the plant, being of a like character to its predecessor, may have fallen a victim to some germs or spores remaining in the land. The field had been under cultivation for Parsnips for some years, that crop coming every third season, and the canker had so developed itself recently that Parsley had been sown instead."

The first examinations having been all with regard to insect injury, what now appears the probable cause was not made out in time for determination this season; but, waiting complete information, it may be observed that in either of the above cases it would be desirable not to let Parsley follow Parsnips; likewise, that infested plants of either kind should be burnt to destroy the enemy, whether it should turn out to be "rust" maggot, or, as is much more likely, *Peronospora*, propagated by spores (equivalent to fungus seeds) in leaf and stem or root. Further, a dressing to infested ground, such as would kill the "spores" or maggots, as the case may be, which in either case would be near the surface of the ground, would be certain to do good.

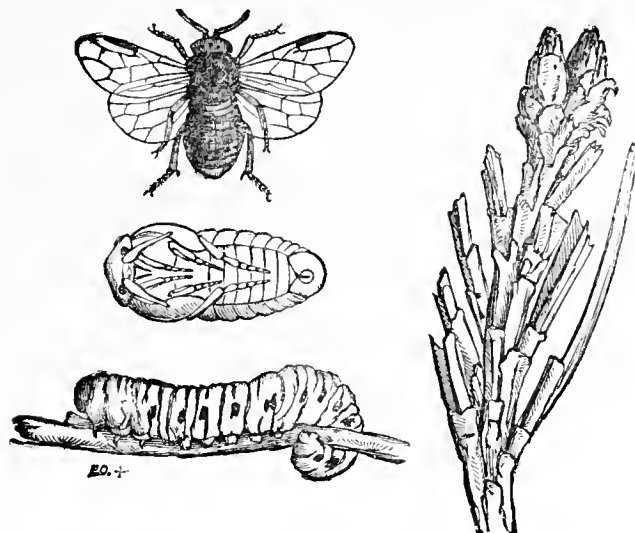
A good dressing of caustic lime or caustic gas-lime, with due care as to quantity, would be sure to be serviceable. With regard to gas-lime, I have a note of a very good crop of Parsley following its application; and at present in my own garden I have plants of autumn-sown Parsley thriving well on a line of ground which was well watered with soft-soap and kerosine (see p. 54) a short time before sowing, and where gas-lime was afterwards thrown amongst the young plants.

This attack causes so much inconvenience to Parsley growers that further information as to its origin and prevention would be gratefully received.

* See 'Diseases of Field and Garden Crops,' by Worthington G. Smith, p. 239. This little volume contains such a large amount of useful information, profusely illustrated with figures of microscopic fungi, that I add the publisher's name—Macmillan & Co., London.

PINE.

Pine Sawfly. *Lophyrus pini*, Curtis.



LOPHYRUS PINI.

Pine Sawfly, pupa (taken from cocoon), and larva; magnified. Pine leaves injured by Sawfly.

On the 14th of July Mr. W. E. Cattley, of Edderton, Ross-shire, wrote to me regarding an unusually severe attack of Pine Sawfly caterpillars, and his communication is of great interest, as he gives an observation of the summer brood of caterpillars developing to Sawflies early in September.

Possibly the existence of this summer's brood in Scotland, as well as in Germany, may be known to foresters. I have had a few or solitary specimens of summer cocoons, and also an observation of the attack of caterpillars at Darnaway, Forres, having suddenly vanished in the early part of July, 1881, after a cold wet day; but otherwise nothing possibly bearing on this subject has previously been sent in by the contributors to these Reports, and the subject is of much importance relatively to methods of prevention of attack.

Mr. Cattley observed:—"Six or eight years ago I enclosed a portion of moor—say seventy acres—and planted it with Scotch Fir and a few Larch. The ground rises so that the upper end is about 200 ft. above the lower. The trees at the lower end are about 5 ft. high, and those at the upper end $1\frac{1}{2}$ ft. to 2 ft. high.

"The first I saw of the caterpillar, which I take to be *Lophyrus pini*, was three years ago, but they were then few. This year they have increased alarmingly, and I have kept two men for a fortnight killing them with paraffin or crushing them with a thick glove. But they are fairly beating me; and among the smaller trees, at the upper end they have stripped the trees like a swarm of locusts.

“In some instances they have spread on to the Larch, but not in such close phalanx as when at work on the Scots Fir. I took a branch or two home, and enclose the chrysalids of two which changed in the house. They appear whiter and flatter than the plates show.

“I have never been able to catch the flies; when I have seen them they have darted down through the tree and sheltered themselves in the rank heather at the root. In the belts where grass and not heather covers the soil they appear in small numbers. They attack the Austrian and Corsican Firs as readily as the Scotch.

“I am persuaded that where the trees are small, up to 3 ft. (that is to say, forty acres, about 200,000 plants) they will not survive.”

On July 30th Mr. Cattley sent me the following note, which well describes the complete disappearance of even a widespread attack of caterpillars when the time has come for their change to chrysalis:—

“I was absent from home for a fortnight, and on my return the caterpillars had completely disappeared; no doubt they had spun and hidden somewhere. But where? My men and I sought them high and low, and only found two esconced within the whorl from which the leader shoot of a Fir, 5 ft. high, had sprung. We searched also in the deep heather, 1 ft. or 1½ ft. high, at the root of the tree, and did not find one.

“One thing that I remark is that, though the tree may be stripped bare in all other respects, the terminal shoots both of leader and laterals being the growth of the year, is never touched by the caterpillars.”

Later on (Oct. 15th) Mr. Cattley wrote further with regard to the above habit he noted August 25th:—“A few clusters of Sawfly caterpillars are seen on the Firs. They now feed on the shoots of the year, which the spring brood avoided.

“These latter grubs are much larger than the early lot which had disappeared; they are paler in colour, and sometimes yellow. I carried a cluster home, and fed them till they changed to the cocoon. The cocoon is like the spring lot, except that it is one-half larger”; this was at the end of August. On Sept. 6th some of the previous lot of Sawflies had come out (of the summer cocoons), the males smaller and sparer than the females, with broad comb-like antennæ and black in colour; “and after these had come out I found *scores of empty cases not in the ground, but in the rank growth of heather.*

“The late batch of caterpillars go, like the early ones, in close phalanx, as close as they can place themselves. There is not one group of these for a hundred of the early lot. To-day (Oct. 15th) not any are to be met with, but I have seen them within a fortnight.

“Trees that have been attacked for years in succession have a dwarfed and tufty appearance, but I have not often found them killed

outright. Where the Aphis and Sawfly both attack the same tree I think it is generally fatal."

The development of Sawfly caterpillars is subject to extraordinary variety, both of date of the time when they leave off feeding and of duration of time before they develop into Sawflies, which may occur in two or more years after that in which they went into cocoon. The following quotation from the 'Forst Zoologie' of Dr. Bernard Altum gives a clear account of the dates of change when the broods take place in one season :—

"The Sawflies are found at two different times in the year—in April and July. Larvæ are found in May and June, when they feed on the Pine leaves of the previous year. They turn to pupæ in the beginning of July, and after two or three weeks develop into Sawflies (or in August or September). The larvæ from these live on the Pine leaves of the present season, and (quite differently to the first set, which form their cocoons on twigs or Pine leaves, &c.) these go into cocoon in the earth. Here the caterpillars lie in cocoon the whole winter through without becoming pupæ until spring, a period of nine months for the metamorphoses, which happened so quickly previously.

"However, *all* winter cocoons do not belong to the caterpillars of the second generation ; it often happens that there is *only one generation*, and the caterpillars of this hybernate in the ground in cocoons."*

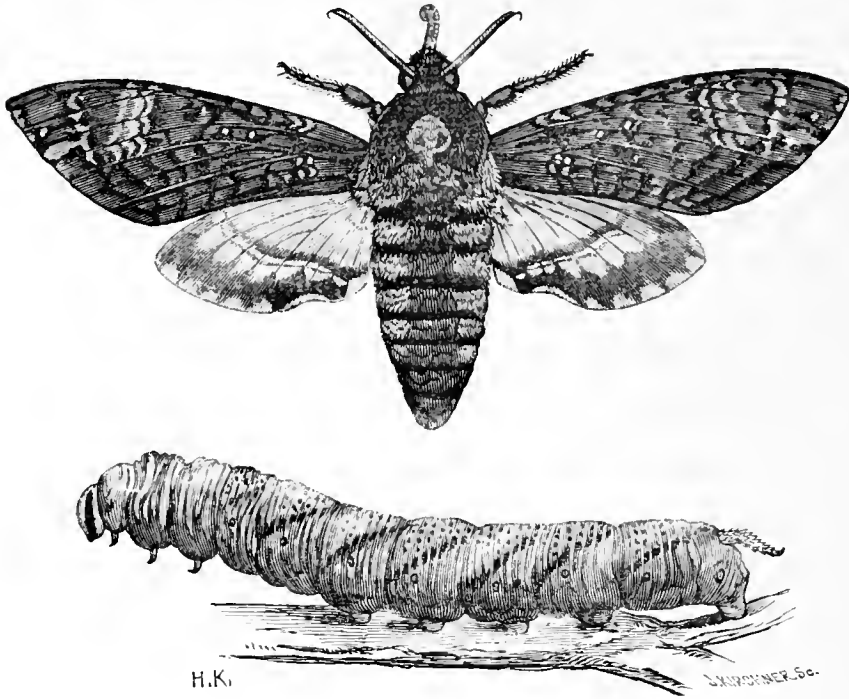
There may be difference in detail, as, for instance, the second set of caterpillars feeding to some extent on the old Pine leaves, as well as those of the previous season, or going into cocoon under moss or surface-rubbish ; but the above quotation gives a good description of the general history where there are two broods, and agrees well with Mr. Cattley's observations.

The knowledge that when there is a sudden disappearance of the Sawfly caterpillars in July, that it is very possible they will be found in cocoons on the twigs or on heath or low-growing plants beneath the infested trees, may be made very serviceable. The cocoons may be pale grey or black, or drab, about a quarter of an inch long, and of a blunt oval or rounded shape, and if the heath, or whatever it may be on which the cocoons are formed, is cut and burnt, a large part of the second brood would be destroyed. If the caterpillars instead should have gone under surface-rubbish, this might, as before noted, be gathered up and collected in heaps and burnt.

* 'Forst Zoologie,' von Dr. B. Altum ; Insecten, Part ii., p. 269.

POTATOES.

Death's Head Moth. *Acherontia Atropos*, Curtis.



ACHERONTIA ATROPOS.

Death's Head Moth and caterpillar.

During the past year specimens of caterpillars of the Death's Head Moth were sent from two localities.

These splendid caterpillars are of the shape figured above, and when full-fed grow as much as four or sometimes five inches in length. The colour is usually yellowish, with the back spotted and tubercled with black, and the sides marked with seven pairs of blue or lilac stripes. Each pair slants backward so as to form a kind of point on the back, and the lowest end of the stripe is variously marked with white or white and black. The distinguishing point, however, of the caterpillar is a kind of tail-like horn at the extremity. This is tubercled, bent down, and then slightly turned up again at the tip.

These caterpillars feed on various kinds of plants, as the Elder, Spindle tree, and others, but their favourite food is the leafage of Potatoes. They usually do not feed until evening, and from their great size, if they chance to occur in large numbers, they cause very considerable damage.*

The greatest recorded appearance I know of is mentioned by Stephens, of nearly a bushel of the chrysalids being procured from the

* For accounts of this moth see 'British Moths,' by Professor J. O. Westwood, vol. i., p. 9; and 'British Entomology,' J. F. Stephens (Haustellata), vol. i., p. 114.

Potato fields near Ham, in Essex; and also an observation sent to myself some years ago of such a numerous appearance of the moths at a locality on the Cornish coast as to be a serious annoyance by coming to the lights at night. They are chiefly noted as occurring across the southerly part of England, but I have had a specimen from as far north as Stanger Gill, Thurso, Caithness, N.B.

The caterpillars are full-fed about August and September; they go down into the ground and turn to chrysalids some depth below the surface. The moths usually appear about October, but it has been stated that those that do not turn to chrysalids till late remain unchanged until next spring.

The moth is a splendid creature, sometimes from four to five inches in the spread of the wings. These are variously marked with rich brown, orange, and black, and the hinder wings are orange, with dark bands; but the moth may be best known by the scull-like mark on the back, whence it takes its name.

Where these caterpillars are numerous enough to need attention, the best plan to get rid of them is to observe which plant is attacked, and then look for the caterpillars either amongst the leafage or beneath the surface of the ground by the plant. The grub usually rests by day, and comes out to feed in the evening and night; from its great size it is easily observable in the bright late summer or early autumn moonlight, and could be then got rid of by handpicking; but (if any remedy is needed) probably stirring over the ground by the attacked plants with a stout pointed wooden peg would be the best way to find and get rid of the creature.

As these caterpillars are somewhat rare, and their finders usually desirous to see what they turn to, I may add I have never had any difficulty in rearing the moth by simply placing the caterpillar with a supply of its food on a bit of garden ground under a wire gauze dish-cover (any old one answers the purpose). Thus the caterpillar can, when full-fed, bury itself as deep as it pleases, and be quite undisturbed in quite natural circumstances till it changes, when the gauze cover imprisons it for its owner.

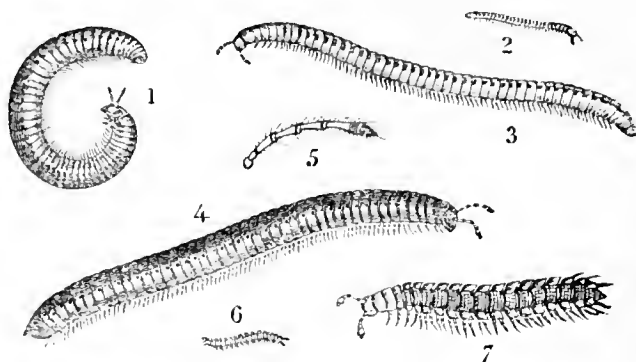
False Wireworms; Julius Worms; Millepedes.

Julidæ; Polydesmus.

The Julius Worms or Snake Millepedes, and the flattened Millepedes (figured), all known under the name of False Wireworms, do so much harm to various kinds of root-crops, as well as to Wheat, that it is difficult to place them under any special heading.

At Spurstow Hall, Tarporley, Mr. D. Byrd found the flattened Millepedes early in November attacking the Magnum Bonum Potatoes.

He mentioned, on Nov. 8th, that a portion of these were attacked by Wireworm-like creatures piercing their way into the tubers, and when the Potatoes were lifted these grubs (so to call them) were to be seen half-buried in them, but, on being exposed to the air, they drew themselves out and fell to the ground.



JULIDE; POLYDESMUS.

1, *Julus Londinensis*; 3, *J. guttatus* (*pulchellus*, Leach); 4, *J. terrestris*; 5, horn;
7, *Polydesmus complanatus*; all magnified; and 2 and 6, nat. size.

The specimens sent showed that the attacker was the *Polydesmus complanatus*, figured above. The Potatoes were pierced as if by large shot-holes, and the Millepedes were still feeding in them.

A little later on (Nov. 27th) specimens of the same kind of Millepede were sent me, together with samples of the Wheat they were attacking, from near Princes Risborough. Curtis says of this kind, "This is reported to be by far the most destructive species;" and he mentions that in April considerable numbers of the smaller ones were detected eating the roots of Wheat; and likewise in November, young Wheat, which was going off when grown to about half an inch to an inch in length, was found to have this same kind of False Wireworm swarming round the grains, which were much injured. The doubt was whether they fed on the grain before or after it became in a sickly state, but from subsequent observation it may be presumed it did so in both conditions.

Specimens of the "pink-spotted" Julius Worm, *Julus guttatus*, were sent from the Gardens, Farm Hill Park, Stroud, by Mr. Charman about the middle of November, with the note that this kind of Millepede was becoming quite a pest. He mentioned:—"I found them in ripe fruit of Strawberries last year, and this year in almost all root-crops, Potatoes, Onions, and Celery."

Mr. Arthur Ward, writing from The Gardens, Stoke Edith Park (with the observation that his remarks refer mainly to garden crops and manure used in the garden), notes:—"I have not the least doubt that a great many of the insect-pests are carted or wheeled on to the land with the manure, especially from what gardeners term the

'rubbish heap,' where a great quantity of green refuse gets thrown together with leaves and sweepings, &c., from the garden.

"I have always noticed this kind of soil (after all has become decomposed) to be full of insects, of which *the greater part are the Julus worms*, and these attack Potatoes, Carrots, and Onions; and this year I find great numbers of them on late Celery. Such soil ought not to be used for at least two years, during which time it should be well turned over, and plenty of lime mixed with it."—A. W.

"The Snake Millepedes are general feeders, consuming both decaying and living animal and vegetable substances. They prey upon slugs, small snails, insects and their larvæ and pupæ, earth-worms, &c. They also feed on living vegetables, and various plants are often injured by their attacking their roots. In particular they feed upon our root-crops, Potatoes, Carrots, &c."—'Aptera,' A. Murray, p. 16.

These Millepedes continue in their somewhat caterpillar-like shape throughout their lives. At first they have only three pairs of legs; this number is increased afterwards with the moults of the skin, but they do not go through changes of form, and never get wings; consequently, in many cases it appears beyond doubt that they were brought on the ground in the manure. They lay eggs about Christmas, so that thorough disturbance of the soil, such as takes place in winter digging in gardens, would be good treatment, and they are said especially to thrive in undisturbed dampish ground.

The London Snake Millepede, *Julus Londinensis*, Leach (fig. 1), is about an inch long, blackish or of a dark lead-colour, with about eighty pairs of whitish legs, looking to the naked eye like a fringe on each side of the creature. This is recorded as being found infesting roots of Wheat in Surrey, but we have not notes in any of these cases of whether the Millepedes were noticed doing harm to the preceding crop. The Snake Millepedes do not arrive at full growth or propagate till they are two years of age, so that, unless brought on the land in manure, it seems likely that the attacking Millepedes or their parents would have been noticeably at work in the preceding crop; and, in further observations, any notes of what might be seen in manure when applied, or other notes, would be very serviceable, for the treatment of this attack has been very little studied.

The common pink-spotted *Julus* may be collected in great numbers by large pieces of cut Mangolds; I saw it thus in May swarming on pieces of root at Sharsted Court, Kent. The only application which has as yet been reported as entirely successful as a remedy is salt, which was noted in 1883 by Mr. J. Addison, Mapledurwell, as being an easy way of killing them; and he also found they were attracted to cotton-cake.

RASPBERRY.

Red Maggot ; Gall Midge Maggot. ? *Lasioptera Rubi*, Heeg.

On the 2nd of November a packet of Raspberry twigs was forwarded to me by Mr. C. Whitehead, of Barming House, near Maidstone, with the note that they had been forwarded to him as being infested with some plant-pests in the places abnormally swollen.

On examination these stem-galls or swellings proved to be inhabited by one or more maggots of the same nature as the Red Maggot of the Wheat Midge, noted at p. 31, though differing from it in gall-making habits. It was impossible to name the species from specimens still not advanced beyond maggot-state, but the description of the injury caused by the *Lasioptera Rubi* (Heeg.) corresponds almost precisely with the condition of the specimens sent.

It is stated by Kaltenbach that these grubs (the larvæ of the *Lasioptera Rubi*, Heeg.) live in companies in woody stem-galls, and are to be found in Raspberry stems. The reddish maggots cause round swellings of the stem, in which they lie apart from each other. *The galls which remain through the winter produce their flies in the spring* (see 'Die Pflanzenfeinde, Insekten,' p. 238). The flies reared from galls of the above kind by Kaltenbach himself were considered by him to be of *Lasioptera argyrosticta*, Meig.

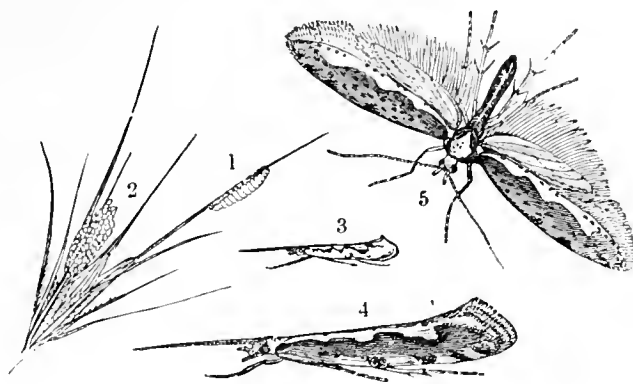
The exact species of what we have cannot be settled without seeing the fully-developed insects ; but, judging by what appear to be its habits, it appears that increase of the attack might be quite checked by carefully cutting away all the stems that bear these roundish swellings or galls on them before the time at which the flies or midge-gnats come out in the spring, and carefully destroying these galls. They should all be burnt, not on any account thrown to the rubbish-heap, or the maggots in the galls would develop to midge-gnats just as perfectly there as on the stems.

It would be very desirable to stamp out an attack of this kind at once, or it might increase to a cause of serious loss in bush-fruit farming ; and there is no difficulty in making sure whether it is present by just cutting through a swelling or two to see whether there are maggots within.

This attack is also found on the stems of one and possibly of several kinds of Brambles ; therefore, clearing away Blackberries—that is, Bramble plants—from hedges near Raspberry grounds would be very desirable.

TURNIP.

Diamond-back Moth. *Plutella cruciferarum*, Doubleday ; *Cerostoma xylostella*, Curtis.



CEROSTOMA XYLOSTELLA.

1, caterpillar ; 2, eggs ; 3—5, Diamond-back Moth, nat. size and mag.

The Diamond-back Moth caterpillars have again appeared at some of the same localities where they damaged the Turnip leaves in the previous season. Notes of their life-history were given in the Report for 1883, with a few observations showing that—whether or not nitrate of soda or other stimulating dressing carried the plant over attack when it was fairly established—it was certain that a weak growth threw it under the power of the caterpillar.

On August 8th, 1883, it was noted from near York, relatively to this attack, “that there were bad accounts from some farms in the district up to a week before,—the Turnip plant had been looking very weak from the wet cold weather”; in 1884, from the reverse (from dryness and heat) it is open to supposition that the Turnips were checked from this cause, and certain that at Kipling Cote (one of the localities reported from) the soil at sowing-time had been in exceptionally bad state for the operation (see Turnip Fly, p. 84),

The only remedies which appear to act are nitrate of soda, or such dressings as may drive on growth, and sometimes sweeping the plant with boughs fastened on a scuffler, or sending sheep through the field,—in short, the remedies which are used for Nigger or Turnip Sawfly caterpillars. It certainly, however, seems as if something might be done in the way of *prevention*. The caterpillars spin up both on the ground or on their food-plants, whether these are crop-plants or common weeds mainly of the Cabbage kind, such as Jack-by-the-Hedge, Hedge Mustard, &c., and the autumn chrysalids do not change to moths till spring. It does not seem at all likely, looking at what occurs in regular course of husbandry to Turnip leaves, and to the

land on which the Turnips grew, that any large amount of cocoons *could* remain on the field uninjured. The leaves are destroyed; if the Turnips are fed off on the land the cocoons would quite certainly be crushed or smothered, and, if merely ploughed in, it is probably they would be killed, their nature being to lie on the surface in the air.

It seems to me therefore that this attack probably comes from the caterpillars on neighbouring wild plants. In 1883 Lord Walsingham favoured me with a note of the Diamond-back caterpillars having been seen by him in great numbers feeding on the fine-leaved Hedge Mustard or Flixweed (*Sisymbrium Sophia*), and, as this plant is to be found on rubbish-heaps by roadsides and the like places, "except in the extreme north of Scotland," it might be well to watch next season whether it was one of the weeds of the regularly infested districts.

On the 19th of August Mr. W. Tait, of Broomend, near Inverurie, N.B., forwarded a package of leaves of Swede-Turnips taken at random from a four-acre field at Crichtie (near Inverurie). Mr. Tait wrote:—

"I did not see a single Turnip, and hardly think I could have seen a single leaf, that was not affected more or less like those sent. I saw a considerable number of moths. When at rest they seemed of two kinds (both *Tineæ*), a few apparently all cream-coloured, but the great majority seemed to have a cream-coloured back (or inner margin) with the rest of the wings dark brown. The Diamond-back Moths are variable in colour.—Ed.]

"I have never seen such a plague before. I ought to have said that the margin of the field and a few missed drills are sown with *yellow* Turnip, but they are only slightly affected."

The specimens sent me proved to be of Diamond-back Moth, and on the 26th of August Mr. Tait, writing further, mentioned he had captured some of the moths, and identified them as Diamond-backs (by Stainton's 'Mannal.') He observed:—

"I could only lay hands on one larva; they seem all to have *spun* up on the back of the leaf, but it was too wet to make a very extensive search. I have seen several fields during the last day or two in different localities all more or less affected"; and Mr. Tait noted that by report he considered the attack must be *general over the north-eastern district of Scotland*.

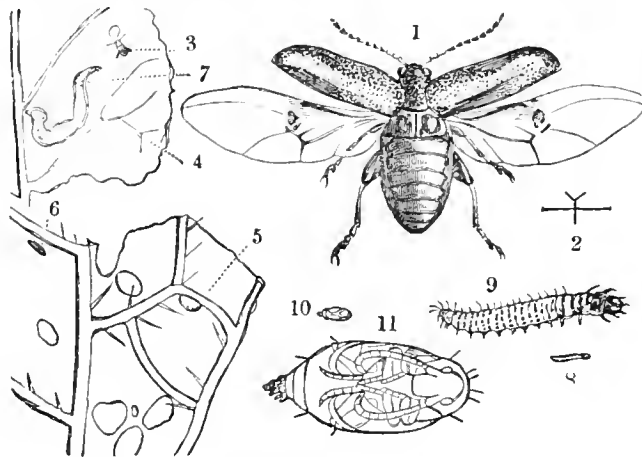
On August 15th Mr. James Thomas forwarded me specimens of Diamond-back caterpillars from North Otterington, Northallerton, Yorks, with the following note:—"Up to the 1st of August I had a most beautiful prospect of a splendid crop of Swede-Turnips, but about that date a kind of blight came upon them, and now the crop of *ten acres is almost* dead. On examining the leaves [a sample of which was sent—Ed.] I find they are nearly all perforated to a considerable

extent, and there are large numbers of a small green worm, of what kind I cannot tell, but I am persuaded that the little green worm is doing all the mischief. The bottom or under leaves are faded green, and the top leaves are blue, same as sample enclosed. The land on which the Swedes are growing is very fine light soil, and had a good crop of Barley on last year. It was manured with fold-yard manure last autumn, and had about 5 cwts. of mineral superphosphate sown with the Turnip seed about the first week in May."

Mr. E. Riley, writing from Kipling Cote, Market Weighton, on July 14th, said:—"I am sorry to tell you that the Diamond-back Moth has again made its appearance among the Turnips about a week ago, and I think in larger numbers than last year"; and on the 13th of August it was further reported, from the same locality, "the caterpillar of the Diamond-back Moth is very busy amongst the White Turnips and Rape."

On the 2nd of August Mr. Henry Stourton, of Holme Hall, York, noted:—"I have seen a good many Diamond-back Moths about, but as yet I have not seen any caterpillars."

Turnip Fly. *Haltica (Phyllotreta) nemorum*, Curtis.



HALTICA NEMORUM.

Turnip Flea Beetle, eggs, maggot, and pupa; nat. size and mag.

Mr. T. H. Hart sent me the following note from Kingsnorth, Kent; and I think it is of interest both in drawing attention to the fact that Turnip Fly does sometimes injure the rough leaf (a circumstance not enough considered), and likewise in the account of the seed lying dormant until the heavy rain came and started it into good growth.

Mr. Hart says:—"Turnip Flea was very troublesome in the spring and early summer. Cottagers' plant-beds were swept off, as also in many cases early-sown Turnips and Swedes. One of my neighbours

had to plough up about five acres of Swedes and resow. Notwithstanding that I got a splendid seed-bed the ground was too dry for the seed to germinate. A plant here and there came up, and for some time it appeared as if they would be allowed to stand; but on July 7th and 8th the insects came in a swarm. In a few days the younger plants were reduced to a stump, *while those with rough leaves were so disfigured as to be almost unrecognisable.*

“The Flea continued to devour the young plants as they came up till the heavy storm of July 24th, when 1·10 in. of rain fell in seven hours, after which we saw no more of them. This rain brought up the bulk of the seed after lying in the ground four or five weeks, and, although rather late, I am thankful to say I have a very nice piece of Swedes and Turnips without resowing.”

Mr. P. Loney, writing from Marehamton, Berwickshire, on the 19th of June, observed:—“We were wonderfully free from all insect-pests last year [1883, Ed.]. The Turnip Fly was absent; in no case did we hear of or see a field where it was in any numbers to cause anxiety. But this year (1884), where stubbles were late in being ploughed, they are present.

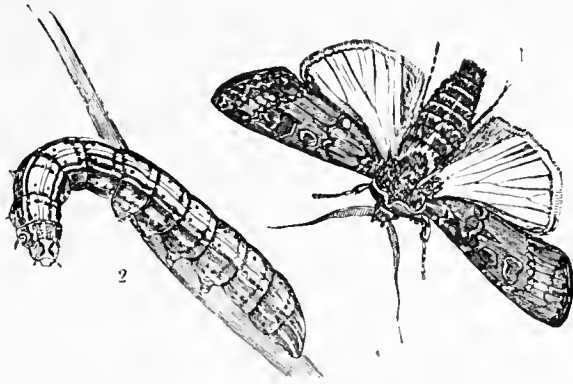
“A striking case of this came under my notice a few days ago. A field of twenty acres, half of which was ploughed in the autumn, the other half in the end of April,—the field was all wrought together, and sown with Turnips. *The late ploughed half is very bad with the fly or flea, whilst on the other half scarce an insect is to be found,* clearly pointing to the advantages of early ploughing.”

Mr. E. Riley, writing from Kipling Cote, Market Weighton, on July 14th, mentioned that “the Turnip Fly is still singularly destructive. I never remember seeing it so voracious in July. We generally consider all danger past when July comes in, or before.

“I never saw Turnips ‘go in’ in a worse condition as regards the soil. May and June were very dry; the land worked what we call very ‘knotty,’—that is, no fine mould,—all the top soil for two inches deep being the size of nuts or walnuts—nothing kindly—and *such shelter* for the Fly. There is every prospect of a bad Turnip crop on the high wolds.”

Mr. Riley’s note of the weather and consequent bad state of land at sowing-time deserves attention, for it confirms what is so strongly laid down of the importance of a good start and healthy growth in pressing ahead of insect-attack.

“**Surface-Caterpillars,**” or larvæ of **Turnip Moth**, *Agrotis segetum*, Westwood; **Heart and Dart**, *A. exclamatoris*, Linn.; and **Yellow Underwing**, *Tryphæna pronuba*, Linn.

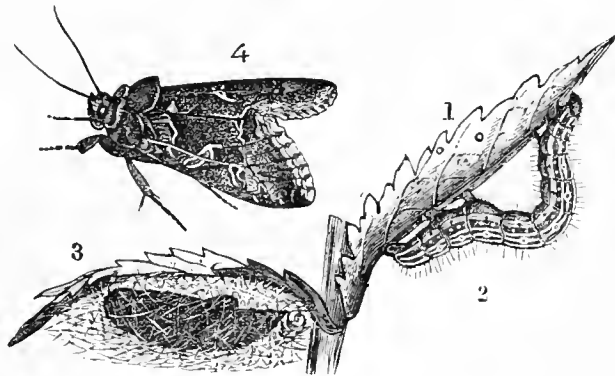


AGROTIS SEGETUM.

Common Dart Moth ; 1, moth ; 2, caterpillar.

Various kinds of the caterpillars commonly known as “Surface-caterpillars” did more harm than usual last year, probably in part for the reason suggested by Mr. Glennly that the season was so dry that the plants had not power to grow well past attack ; also the warm and settled weather would be favourable to the moth, and the young caterpillars would not be materially lessened in number by the heavy rains, which sometimes are of great service in checking moth-caterpillar ravage.

We had an instance of this in 1879 in the great appearance of the Silver-Y or Mangold Moth, *Plusia gamma* ; it was noted that the caterpillars, which were very numerous about the middle of August near Maldon, in Essex, “were destroyed in immense numbers by the persistent downpour of rain.”



Mangold Moth, caterpillar, and chrysalis in cocoon.

Damage was reported last year from the Surface-caterpillars of three kinds of moths, of which the general habits are much alike : the Dart or Turnip Moth, *Agrotis segetum* ; the Heart and Dart Moth, *A. exclamatoris*, also very injurious to Turnips ; and the Great Yellow Underwing Moth, *Tryphæna pronuba*. The size, shape, and markings of these various moths and caterpillars are given by their respective figures.

The moths are to be found about June, the caterpillars for the most part feed at night, and hide themselves by day sometimes under stones or clods, and, when winter draws on, bury themselves beneath the surface, or feed according to circumstances of weather or otherwise, and in spring come out again to feed. When full-fed, which may be between March and July (or in the previous autumn with *A. exclamatoris*), the caterpillars turn to brown chrysalids in the earth.

The various caterpillars may be generally described as of a smoky purplish or greenish colour, greenish or paler below, with brown or ochrey heads, and variously striped or marked, as figured, with various shades of brown. They all have the habit of rolling themselves in a ring when disturbed. The Turnip Moth caterpillars are distinguishable from the Heart and Dart caterpillars, often found with them, "by being very horny and shining, which is much less the case in *A. exclamatoris*."

The caterpillars of the "Turnip" or "Dart" Moth were the most common last year. These grubs are said to feed at first mainly above ground, and, by gnawing through the plants at ground-level, do enormous mischief very rapidly. When they are older they remain under ground, or come up at night to feed; and the place where they are may sometimes be known by the sticking out of a piece of Turnip leaf from the burrow, down which it has been dragged for consumption during the day. They are known to feed on almost all our root-crops, and likewise on the roots of corn and grass; but this year notes were sent in, with specimens accompanying, of their ravages amongst Celery and on a four-acre piece of Squills; and (on the small scale on which it could be noted in my own garden) I found injury from them amongst young Cabbage when just put in after Onions.

The first appearance of Surface-caterpillars was mentioned by Mr. W. W. Glenny, writing from Barking on the 27th of March, as follows:—"We have had plenty of the Cabbage grub marching about lately, which is an uncommon outcome of a mild winter. These insects generally hide themselves just under the surface, and do most harm in August, nipping off the small seedling plants when they are young and tender. I never noticed them so lively in February before."

On Sept. 4th Mr. Glenny forwarded an account of the unsatisfactory following up of the unusually early appearance:—

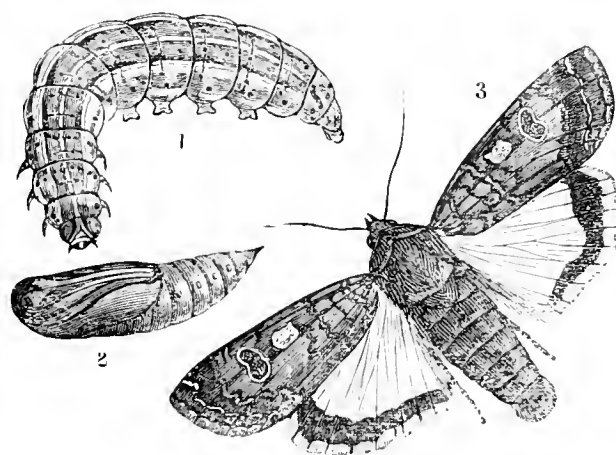
"Surface-caterpillars have been exceedingly destructive, especially amongst the Cabbage seed-beds. The long continuance of drought caused the seed to germinate at irregular intervals, and the young plants came up slowly. This gave an advantage to the foe, who attacked the single plants as they appeared above ground. Morning by morning it was easy to mark the work of devastation that proceeded without interruption during the night.

"Plots of ground where early Carrots have been cleared, or land adjoining such plots, are particularly liable to attack.

"If the seed-bed abuts on land as described, you may even in passing note a zigzag edge, which shows plainly how the vermin travel from one plot to another. It leaves a wave-like appearance to the side of the field as the insects eat their way into the crop.

"The most effectual way of checking them is to hunt for these caterpillars just below the surface periodically, say twice a week. By these means the attack may be lessened, and a crop saved.

"This year, having been dry, the caterpillars have given much trouble amongst transplanted Leeks, and one field of about four acres was searched more than once; the result was satisfactory, large numbers were destroyed, and the crop in the main saved. In dry seasons like this the plants grow slowly, and the mischief done is more apparent; whilst in damp seasons the rapid increase of foliage makes the damage less noticeable."



TRYPHENA PRONUBA.

Yellow Underwing Moth ; 1, caterpillar ; 2, chrysalis ; 3, moth.

Specimens of Surface-caterpillars, sent by Mr. Glenney on October 27th, proved to be of the Turnip Moth, *A. segetum*, and the Great Yellow Underwing, *Tryphana pronuba*, figured above.*

* These Yellow Underwings are much oftener observed than the grey Turnip Moths, by reason of their bright yellow under wings, banded with dark brown or black, from which they take their name, and which make them very noticeable as they rise, towards the latter part of summer, before the passing foot in recently-mown grass or low-growing plants. Their chief time of flight is, however, in the evening or night; they lay their eggs in some quantity at the root of various kinds of plants. The caterpillars hatch in about a fortnight. By day they lie hidden, rolled into a ring in the earth under their food-plants, or sheltered under clods, stones, or the like, and come out at night to feed. The lumps of dirt and gnawed leaves show their whereabouts. During the winter months they may be found near the surface of the ground, and in spring they come out again and feed. When full-fed in the late spring or early summer they bury themselves and turn to chrysalids,

Mr. Glenney notices, in one of his communications, that, though "they cannot be seen on the surface, they are easily found by noticing where a blade has been cut off, and then moving the soil gently."

On August 13th Mr. Riley sent specimens of the Turnip Moth caterpillars, *A. segetum*, from Kipling Cote, near Market Weighton, where they were attacking the Turnips.

On August 14th Mr. J. T. Edge, of Strelley Hall, Nottingham, forwarded specimens of caterpillars of the same species, *A. segetum*, and also of the roots of young Swede Turnips eaten off by these grubs, with the following good observation of habits:—

"The grubs appear to attack both Swedes and White Turnips; they are found an inch or two below the surface close to the Turnip root; they have a burrow up to the surface, where they attack the Turnip, eating it off just level with the ground. I have found as many as four grubs at the root of one Turnip. We have not observed this destruction of Turnips till to-day, but the grubs are now doing a great deal of damage. I observe the Rooks seem to like them."

On August 14th Mr. James Craig forwarded specimens of caterpillars of the same kind of Turnip Moth, mentioning:—"I enclose along with this sample of grubs infesting Turnip field; the crop is fast going with them.

"On one end of the field I put a cart-load of gas-lime, and on the other 2 cwt. of crushed rock-salt. These two ends are not so badly infested as the middle of the field, where only the manure was put; this was 18 loads of farmyard and 6 cwt. bag manure per acre. The grubs are found in the soil under the plants."

On Sept. 16th specimens of Surface-caterpillars were forwarded from East Hull, near Brandon, Norfolk, by Mr. Upcher, with inquiry as to their nature, and the remark "that they eat the Turnips quite through just below the surface of the soil; they seem to work the drills out regularly, and have destroyed several acres in one of my fields."

On Sept. 23rd Mr. H. C. Bowen forwarded specimens of the caterpillars of the Turnip Moth from Chesterton, Bridgnorth. These had destroyed about half an acre of Cabbages, and were in such numbers that a boy could pick up a hundred in a very short time. The previous crop was Potatoes, for which the land had been well-limed.

This caterpillar—that is, the Turnip or Dart Moth caterpillar—is noted for feeding on almost every plant not too hard for its operations, but I am not aware of Celery having been up to the present time

from which the moths come out about the middle of the summer. See, besides other authorities, 'Praktische Insecten kunde,' of Dr. E. L. Taschenberg, Part iii., p. 151.

included in the list ; the following note, however, points to a good deal of damage being caused by it.

The following communication was sent to me on October 7th by Mr. Cheesman, Secretary of the Natural History Society, Selby, Yorks, with specimens of the caterpillars accompanying, which I identified as the *Agrotis segetum* :—

“ I send two larvæ, which my gardener tells me are the cause of the remarkable flagging of the Celery in this district. As many as from one to a dozen roots in succession in the row may be observed with drooping and flagging leaves, and on the plant being touched it is found that the roots (or rather the solid rootstock) are quite eaten away, as if by mice. But I am told it is the work of the grubs which I send, they going from root to root and making considerable destruction. I saw the two grubs taken from the ground at the end root of about a dozen which had been eaten.”

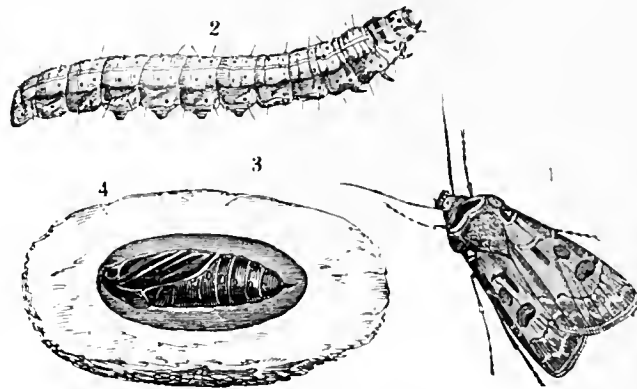
On Dec. 13th Mr. Cheesman further noted :—“ Early in October I sent you some larvæ of *Agrotis segetum*, which were making great havoc in the Celery gardens in this neighbourhood. From that time until now the destruction has been going on ; first the outer leaves are observed to flag, and in a short time the whole of the plant is eaten through at the collar just beneath the surface of the ground. I notice the plants are attacked in succession from root to root in the same row, and are not taken indiscriminately.”

In a case like this it appears to me that searching for the caterpillar near the surface where the injury to the leaves shows its presence could not fail to be of service. Also, where attack was *regularly* and strongly advancing, it would be desirable to break the continuance of the row. If a couple of yards or less of the Celery was dug up and the trench filled across towards the end nearest the plants to be protected with some good shovelfuls of ashes well sprinkled with paraffin or fresh gas-lime, such of the caterpillars as were not previously removed with the Celery would almost certainly be killed, or prevented advancing.

The caterpillars noted below appeared to be of the Heart and Dart Moth, *Agrotis exclamatoris*, Linn., which also is very injurious to Turnips, and also sometimes found in large numbers in Potatoes. This is somewhat flatter than the Turnip caterpillar, and not so shiny (see fig. on next page) ; but the specimens were not in a condition in which I could absolutely identify them.

Specimens of Surface-caterpillars, which appeared to be of *A. exclamatoris*, were forwarded from Hewletts, Cheltenham, with the mention that the Rooks destroyed the Turnips by pulling them up when searching for these grubs. Where the caterpillar has gnawed through the tap-root, very slight disturbance is enough to draw the bulb out of the ground.

On Aug. 28th the Rev. J. C. Clutterbuck enclosed Surface-caterpillars, with the mention that they were then much injuring the



AGROTIS EXCLAMATIONIS.

Heart and Dart Moth, caterpillar, and chrysalis in earth cell.

Swedes and Turnips, and, when the plants were quite small, ate quite through the root; likewise that the Rooks destroyed a good many.

On September 15th specimens of injured Swedes were forwarded, showing the power of the bulb of recovering damage when attack ceased, or weather or other favouring circumstances set in.

Mr. Clutterbuck wrote accompanying:—"I send you some specimens of Swedes attacked by the grub: the smallest one was finished off last night, as you see it. You will see that some of the other roots are likely to recover.

"We find that they are affected worst in places under trees, and where the ground was dryer. The larger roots show marks of the grub, but they are now growing fast *after the rains* of a week ago, and I have no doubt that the Rooks destroyed a great many grubs. Some persons blamed the Rooks for rooting up the Swedes, but I have no doubt they were after the grubs. . . . I have some roots now which seem quite to have beaten the grub now, with the help of the Rooks, and will be a fine piece of roots."

The following short observations as to the good effects of salt and artificial manure given by farmers in Weybread parish, situated on the north of Suffolk, were forwarded to me by the Rev. J. H. White, Weybread Vicarage, Harleston; not having permission to use names, I give them simply as memoranda:—

"White Turnips sowed after a heavy farmyard manuring on a piece of lightish land. Result, total failure of crop. At the same time, on an adjoining piece of the same field, he sowed the same sort of White Turnips after an application of artificial only. Result, good crop. Salt mixed with manure considered would be beneficial as tending to destroy any grubs or maggots that might be deposited in the manure.

Sowed a considerable quantity of salt and then applied farmyard manure to a piece of land, and, after ploughing in, sowed White Turnips: this was on light land. Result, a first-rate crop. General opinion that salt consolidates too much to answer on heavy land."

With regard to prevention of spring attack from caterpillars which have hybernated, or have in some way or other lived through the winter where the crop has been on the ground continuously, probably as yet the only method of checking attack is the well-known one of turning the grubs out of the ground by a body of workers sent with strong-pointed sticks, or any other implement, and collecting these and destroying them. But where ground is known to have been infested in autumn, and it can be worked, it is best treatment to *stir the surface well*. The caterpillars which are within reach of operations will then be exposed to weather influence, which will act strongly on them, although it would not in ordinary amount of cold have done them any harm in their own naturally-formed or chosen shelters. In the course of the past winter I turned some Surface-caterpillars out from the ground in which they had been buried for experiment, or had buried themselves last autumn, and found them in a condition in which they would certainly have soon died if left on the surface.

From state of weather or other circumstances there may be exceptions here and there, but as a rule the plan of a thorough stirring will act well. Thorough cultivation of the surface also destroys the weeds which feed or shelter the grubs, and therefore is a good measure in summer on a field where the crop has been destroyed; and chemical dressings which will annoy the grub are of use. The two treatments joined greatly help to clear infested land by starving and poisoning the pest.

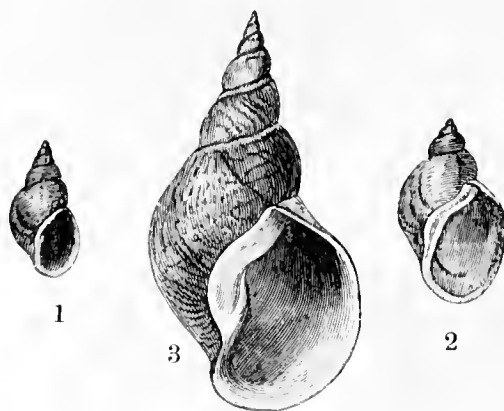
MARSH SNAILS.

Wandering Marsh Snail, *Limnaeus pereger*, F. & H.; **Truncate Marsh Snail**, *L. truncatula*, F. & H.; **Pond Marsh Snail**, *L. stagnalis*, F. & H.

The amount of the presence of Marsh or Water Snails is a subject which might most usefully be inquired into relatively to one or more kinds of Water Snails (or *Limnaeus*) being the "host" of the liver-fluke of the sheep in its early stage.

The life-history of the Fluke and its connection with the *Limnaeus* are given in minute detail by the long and profound research of Prof. A. P. Thomas, F.L.S., in the 17th and 18th vols. of the Journals of

the Royal Agricultural Society (new series), with some observations as to its prevention; but independently of the anatomical and veterinary aspects of the subject some amount of inquiry is sent to me occasionally regarding the presence of, or means of getting rid of, the Snails; and the appearance of these common Water Snails does not seem to be so well known as is desirable. The figure is therefore



WATER SNAILS.

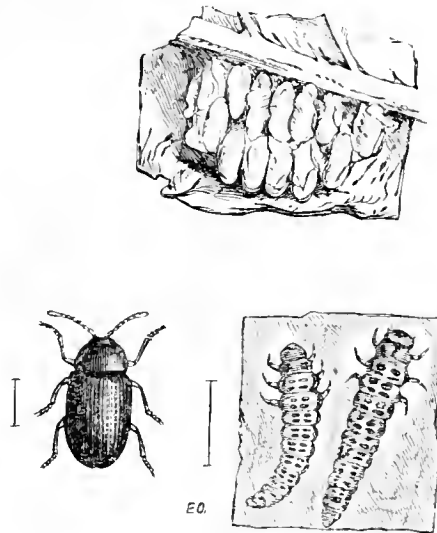
1. *Limnæus truncatulus*; 2, *L. pereger*; 3, *L. stagnalis*.

given of the *Limnæus truncatulus*, which is considered to be the species most infested in the early stage of the Fluke, and the *L. pereger*, sometimes but apparently not so often infested. The *L. stagnalis* is merely added, as, though I am not aware it is a "host" for Fluke, its comparatively large size conveys the appearance of this genus of shells more plainly.

These Water Snails (*L. truncatulus* and *L. pereger*) wander about, and may be found in the damp grass, as well as in pools; but it is stated of *L. truncatulus*, "It deposits its spawn on the mud, which is its usual habitat, and, not like its congeners, on the stalks and underneath the leaves of water plants."—'British Conchology,' vol. i., p. 117, by J. Gwyn Jeffreys, F.R.S.

During the years in which I had personal knowledge of *Limnæus* at Sedbury Park, Gloucestershire, they were excessively prevalent in small field-ponds or drinking-places, where floating water plants, weeds round the bank, and more or less mud, according to weather or season, gave every encouragement to their increase. Clearing the shallow pools of weeds, and removing the broad band of weed-grown or stagnant mud from the entrance end of the pool, would have certainly at once greatly lessened the quantity of Water Snails, and it may be conjectured also that of rot in our sheep, which were constantly affected to a serious extent; and if in the course of the coming season I should be favoured with any notes of field and pond treatment found useful in lessening these living shelters of the early stage of the Fluke, I should be glad to insert them in my next Report.

WILLOW.

Willow Beetle. *Phratora Vitellinæ*, Linn.

PHRATORA VITELLINÆ.

Willow Beetle, caterpillars, and eggs, magnified ; lines showing nat. length.

The Willow Beetle, *Phratora Vitellinæ*, Linn., is a small oblong-oval, shiny beetle about the sixth of an inch long, of a bronze or green or bluish tint above, more brassy below. These beetles come out in the spring from their sheltering places, and feed on the leaves of various kinds of Willows, also of Poplars. Later on the caterpillars or grubs hatched from the eggs of these beetles continue the mischief.

These whitish spindle-shaped eggs are laid in small patches on the surface of the leaves,—whether invariably on the under surface, as in the case of those sketched above, I do not know. The eggs are protected by a loose transparent membranous film. The caterpillars which were forwarded were about half an inch long when full-grown, pale yellowish or whitish, with black head; the segment next the head nearly all black above, and a squarish black mark above the two last segments of the grub; the intermediate segments variably marked with black, amongst which a more or less interrupted series of black marks down the back and black spots on the sides, largest on the three segments next the head, were the most noticeable.

These grubs feed on the under side of the skin of the leaf, working right through until the upper surface is only a film, which dries and cracks away. When full-fed the caterpillars turn to chrysalids in the ground, and from these a second attack of beetles comes up in autumn.

The beetles sent were of various tints, and I incline to think the

Phratora vulgatissima, Linn., was present amongst them, but this does not affect the matter practically.

It will be seen by the following notes that one of the main points to be worked on for *preventing* attack is that of *the beetles wintering under old or loose Willow bark, or under rubbish on or near Willow grounds*, and, in short, like the nearly-allied "Mustard-seed" Beetle, in any snug shelter, but especially such as is formed of rubbish of the plant which is its summer food.

On the 21st of May Mr. Cosmo Melvill wrote from Kersal Cottage, Prestwich, relatively to the Willow Beetle, *Phratora Vitellinæ*, which had then lately made its appearance in extensive Willow beds at Lymn, Cheshire, and was becoming so alarming a nuisance there in its inroads on the Osier beds as to call for unusual exertions to withstand it, and information as to what could be done to extirpate the pest was asked in behalf of the growers of the locality.

On the 28th Mr. Melvill further mentioned that every day the ravages of the insect were extending, and they were *being carted away in bushels*. Paraffin was then being used, and "apparently with some success." The following note regarding the widespread nature of the attack was forwarded:—

"For some weeks past the Willow growers in Lymn, Statham, Thelwall, and other places in Cheshire, have been troubled by the appearance, among their Willow beds (some of which are extensive and very valuable) of numbers of beetles which threaten to destroy all the Willows in the neighbourhood, unless the means that are now being tried prove effectual. A meeting was held at Lymn for the purpose of considering the best means of exterminating the pest, and a resolution was carried which pledged the growers present to continue the use of paraffin oil, with the object of catching the beetles. By this means one grower has caught some millions in one day, and it is believed if this course is followed up the crops will be saved."

On the 29th of May, Mr. H. Cameron, writing from Lymn, Cheshire, informed me that the Willow growers in that district, who were suffering from this insect scourge, had formed themselves into a society for mutual protection and interchange of experience. Of this society Mr. Cameron was the chairman. He informed me that:—

"The remedies hitherto tried (but so far with little success) are dusting the young shoots with hellebore powder, soot, sulphur, lime, and spent gas-lime. *The plan now adopted is to hand-pick, or rather shake off, the insects into small vessels containing a small quantity of paraffin oil.* This plan has been steadily carried on by many of the Willow growers during the last fortnight *with marked success*; but unfortunately a few people take little or no notice, and I fear these neglected lots will pollute the surroundings.

“I am disposed to believe that Paris-green, which you recommend, would be a likely cure.” [On trial (as noted subsequently) this application proved useful.—ED.]

On the 31st of May, Mr. Cameron further informed me that at a meeting held the previous evening most of the gentlemen present reported a great diminution in the number of the beetles, but that he found, on going over the Willow beds before writing, that there were still great numbers left.

Relatively to the sheltering of the beetles during winter under any old bark or similar rubbish at the Willow grounds, which is a most important point in consideration of how to get rid of them, Mr. Cameron remarked:—“Some of our members inform me that during last winter they found a large number of the perfect beetle under the rough bark of the Willow trees, and one grower, who has a wooden hut erected on his Willow field, found, on accidentally removing some of the boarding of this, that the beetles were wintering there in numberless quantities.

“Another informs me that he has found them largely under the bark of old fencing-posts, old boards left lying on the ground under the flood-line, &c.

“This being known, I think some means of trapping during the late autumn or early winter might be devised and prove useful.

“As regards area of land under Osiers, I am not very wide of the mark in saying we have about fifty acres in the Lymn district, and I dare say the adjoining parish of Thelwall, which is affected as Lymn is, will grow a like acreage.

“If the means adopted for the destruction of the beetles do not prove effectual, the money loss in Lymn alone will be very serious this year; but the loss does not end with the season, as Willows, once denuded of the foliage by the beetle, never do any more good, so that three years' crops are lost, besides all the expense of cultivation and replanting of the land.

“The plants are usually put in rows about twelve inches apart each way, and the Osiers are cut down, as a rule, close to the old stock, say ten inches above the ground, every autumn; but occasionally lots are left uncut until the autumn of the second year. In this case I fancy syringing [*vide* remarks on Paris-green, ED.] would have to be resorted to in order to reach the tops of the shoots with any dressing which might be applied.”



Willow leaf partly eaten
by Willow Beetle.

On the 25th of June Mr. Cameron noted further, relatively to estimate of value of Willow crop:—

“I mentioned that there may be about fifty acres of Willows grown in Lymn district, and I feel pretty certain that unless means had been taken early to suppress the beetle, the whole crop, on an average, I am told, worth about £1000, would have been lost. The sum, however, means only the loss of the crop for one year; and, if this should happen, the old stocks would not live; consequently the land would require trenching, paring, and burning and replanting the following year, the replanting alone costing something like £15 an acre, and still the risk of being eaten up afterwards.

“I am glad to say that little damage is being done *at present*, and the Willows are growing well; but, *from the quantity of eggs and grubs* showing on the leaves, I fear the outbreak will recur again in the course of a few weeks, when the Willows are tall and difficult to deal with.

“Picking has been the chief remedy resorted to, but I have got a ten-gallon can, made pretty much on the lines of the one recommended in a report you sent to Mr. Melvill for distributing Paris-green solution.*

* The method of operation alluded to is mentioned in Prof. Riley's ‘Seventh Missouri Report’ (1875, p. 15), and is as follows:—“It consists of a can capable of holding about eight gallons of liquid, and so formed as to rest easily on the back, to which it is fastened knapsack-fashion by adjustable straps, which reach over the shoulder and fasten across the breast. To the lower part of the can are attached two rubber tubes, which are connected with two nozzles or sprinklers. The inside of the can has three shelves, which help to keep the mixture stirred. There is a convenient lever at the bottom, which presses on the tubes and shuts off the out-flow at will, and two hooks on the sides near the top on which to hang the tubes when not in use. On the top is a small air-tube and a capped orifice. Two bucketsful of water are first poured into the can, then three tablespoonfuls of good green, well-mixed with another half-bucketful of water, and strained through a funnel-shaped strainer, which accompanies the machine, and the use of which prevents the larger particles of the green from getting into the can and clogging up the sprinkler. Five to eight acres a day can readily be sprinkled by one man using the can, and from one to one and a half pounds of good green, according to the size of the plants, will suffice to the acre.”

With regard to amount of Paris-green which may safely be used, it is stated that “when in liquid suspension (for Paris-green is insoluble in water) a half-pound may be mixed with forty gallons of water. Double this amount of green, or, in household measurement, a tablespoonful (a little over an ounce and a half) in a pailful of water (four gallons) is often used on many plants without injury when more active results are desired.”—‘First Annual Report of Consulting Entomologist of the State of New York,’ p. 27.

The above proportion appears to be about a third weaker than that noted as mixed, consequently it would be as well to experiment as to desirable strength. The Paris-green being arsenite of copper, and consequently a *deadly poison*, requires to be kept and also mixed under careful supervision, especially if there are children about, as the beauty of the colour is very attractive. The price has been reported to me as 6d. per pound retail.—ED.

“The Paris-green we had difficulty in getting, but a supply has now come to hand, and experiments are being made. One man dressed a few Willows three days ago, and he is sanguine of success. Growers are afraid to use this solution for fear of damaging the Willow, but so far their fears have proved groundless.

“As to the extent of the attack, I cannot say much farther than that in the district between Warrington and Lymm, a distance of five or six miles, all the Willows are affected pretty much alike. At Thelwall, which is about midway, the beetle has been troublesome for twenty years, but not until three years ago did it give any trouble in Lymm. About that time a few plants were affected adjoining the river; last year these plots were very nearly worthless, and other plots were attacked; and so the plague has spread.

“This year (1884) I have no doubt the exceptionally dry season has largely encouraged the increase of the insect. I am told that in Thelwall district* gas-lime, sulphur, hellebore, soot, &c., have been tried as preventives, but without any good effect, and hand-picking has been looked upon as the only remedy. I am sending some more specimens of leaves and grubs.”

On the 24th of July, Mr. Cameron forwarded some more grubs of Willow Beetle, and concluded his series of careful notes with the information that the young Willow crop was then doing fairly well, and the beetles upon them doing little harm; but on two-or-three-year-old plants considerable harm was done.

The Paris-green had been most satisfactory of all the dressings which had been tried. “Indeed, *I believe by applying this dressing early enough the beetle might be kept fairly well under, the difficulty at this season of the year being to get the wash distributed; the Willows grow so thickly on the ground and so high that any spray distributed cannot be used. I find the Willows are easily damaged if Paris-green is used stronger than the quantities given by Mr. G. Leigh in his notes. I think our safety is in early spring work, and trapping of some amount in early winter.*”

On Jan. 24th of the present year, Mr. Cameron confirmed the correctness of the above views by the following report of the state of affairs up to that date, which, I should say, most especially showed the serviceableness of winter trapping on the broad scale in which, in a case like this, it can be carried out.

Mr. Cameron observes:— “Where diligent *hand-picking* was attended to, the crop of Willows has proved an average one; and where the *Paris-green dressing* was applied they have also proved a good crop. Where no remedial measures were adopted the growth

* See also previous report from Lymm, p. 94.

has been small, the stocks showing damage, and in many cases, I fear, they are ruined. A few growers have put down traps, in the shape of old posts and birch-wood bark up trees, &c., in the neighbourhood of the infested Willow beds, and under these traps the beetles have lodged in myriads, and are, of course, being destroyed; but they are mostly found lodged in retreats considerably above the flood-line, and in places where artificial flooding cannot be applied. The pests we find hibernating comfortably under the bark of large Willow trees which grow in considerable numbers along the line up the River Mersey, where the Willow beds are mostly located.

“The Lymm Local Board (of which I happen to be chairman) planted their *new* sewage farm with five acres of Willow last year, and we are arranging to plant six acres additional this spring. All this land is capable of being flooded with sewage, and the experiment will be tried systematically. I am very hopeful of a good result.”

The notes referred to above were contributed by Mr. G. H. Leigh, a Willow grower at Lymm, who tried several experiments for the extermination or prevention of the spread of the Willow Beetles. He notes this beetle being furnished with wings to convey them to fresh Willow pastures, and that they commence their destruction upon the leaves when they first show shoot; after a while they lay their eggs, and thus leave their offspring to make a second destruction.

Mr. Leigh experimented by dusting soot on the plants, but the early part of the summer was so dry, with so little dew, that the soot did not remain on the leaves. He syringed them and dusted the soot, but this also was of no use. Hellebore powder was used with the same result, the leaves being too dry to receive it; but even when the effect was tried of putting the beetle into it (in a vessel) in a quantity beyond what could be put on the Willow plant, it took some fifteen minutes to destroy the beetle. Arsenic was also tried with the same results.

Paris-green “answered much better.” Mr. Leigh mentioned that he then tried Paris-green, with about half an ounce to three to four gallons of water. The Willows by this time were grown three feet high; therefore he could not apply a good spray, but the application to the plants on the compass of ground sprayed with Paris-green *was successful*. It scorched the leaves a *little*, and made them curl, which he believed was the cause of the beetle removing itself; but “it did not injure the main shoot.” Also, it is noted, “I cannot say it killed the beetle right out, as it immediately dropped to the ground, being always on the alert when anything touched the leaves.”

Mr. Leigh says:—“*I am of opinion that all rubbish brought by the winter floods should be destroyed, or buried deep enough so that the beetles could not harbour on the banks.*”

"I am also of opinion that Paris-green, if used early, would prevent, if not completely destroy, them; and if it was more used with a good spray it would destroy it in the early stage."

The following letter from Wigan gives some additional information regarding the life-history of the beetle, and the wide-spread and destructiveness of its attacks, and, like the others, dwells on the very important point of the beetles, which will form the spring attack, *sheltering themselves during winter in the neighbourhood.*

Mr. W. Worthington, writing from Wigan on the 28th of May, mentioned "that the Willow Beetle was doing much damage to the Willow crop in some parts of the country. Specimens were sent from Willow beds about ten miles from Wigan, which had suffered heavily in the previous year. The beetles had again attacked the Willows in great numbers, and a large staff of hands had been engaged in hand-picking. Many ways of getting rid of them had been tried, and paraffin oil had been found the most destructive, but unfortunately it also injured the plants.

"It was noticed that there were two visitations of the pest—the first in May, *when the old beetles* leave their winter-quarters; the second later in the season, just before the Willows begin to ripen. The insects then settle in vast numbers on the tender leaves and shoots of the plants, and in an incredibly short time do an immense amount of damage.

"*When the beetles* leave the Willow beds in autumn they conceal themselves in old fences, hay and corn stacks, crevices of old buildings, &c., where they pass the winter, and emerge to commence their depredations in the following spring, when the Willows have got into leaf."

The above letter was kindly forwarded to me by Mr. S. L. Mosley, from Beaumont Park, Huddersfield, with the mention that the Willow Beetle was very common in that neighbourhood, but on Poplars; and accompanying he forwarded specimens of the beetle and of injured Poplar leaf.

Now, looking over the results of the above observations, firstly as to what remedies have been tried and failed, the knowledge of which will save time and expense in future attack, it is noted that soot, sulphur, lime, and spent gas-lime, arsenic, and likewise hellebore, failed to do good.

Hellebore has not, as far as I see, been tried as a means of destroying the grubs, but Mr. G. H. Leigh's careful experiments appear conclusive as to its being useless for destroying the beetle. Paraffin is noted as of use, and hand-picking obviously cleared enormous quantities of the pests; but, as a direct remedy in the way of application to the Willows, Paris-green appears to have acted best.

This poison has the merit of being an application which has now been tried for many years, and found serviceable regularly on the vast scale on which it has been used in the United States to keep down Colorado Beetle, which is, like our Willow Beetle, a *Chrysomela*, and much like it in habits; and if during the time before the beetles come out some of the Willow growers were to have a tin can made on the plan of Mr. Cameron's, and learn where Paris-green was purchasable, as there is often great difficulty in procuring it on the spur of the moment, it would probably save much money in the end.

With respect to paraffin, it is worth consideration whether the soft-soap and paraffin washes, mentioned under the headings of Hop Aphis and Mangold Fly at pp. 54 and 66, would not be likely to be of great service.

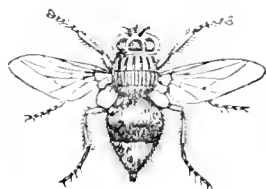
In the mixture given as Mr. Shearer's recipe there is no difficulty as to separation of oil and soap; the can would give a proper method of application, and the stickiness of the soft-soap would ensure the leaves remaining (except in very wet weather) in a condition thoroughly repulsive to the beetles, whether for food or egg-laying.

The great point, however, is *forestalling attack*, and in the above observations with which I have been favoured it will be seen that the enormous importance of doing this by clearing away loose bark-rubbish, rubbish below flood-line, &c., is *again and again* dwelt on.

But there is yet another important point. This attack is one in which non-attention on a single Willow ground does mischief to all near. The Willow growers wisely formed themselves into a society last season to attend to the extermination of this pest, and the result has been, as shown above, that in a few months they have learnt its history, and what measures are or are not of service in checking the attack. If they should think fit to continue to thus co-operate at least for another season, so that they might be fully cognisant of the effects of all methods of treatment, and likewise of those of absence of attention to the subject in their district, the occasional time given to the meeting would certainly be repaid.

OBSERVATIONS
ON
WARBLE FLY OR OX BOT FLY,

Æstrus bovis, Clark ; *Hypoderma bovis*, DeGeer.



OX WARBLE FLY.

THE following observations have been collected in order to place before those interested in the subject some amount of information in a form easy of access regarding the history of Ox Warble attack, and means found practicable and serviceable for its prevention in this country, at the present time, by our own agriculturists and cattle owners. Little has been written in connected form on this attack since the time of Bracy Clark's well-known treatise. German writings, especially those of F. Brauer, give much scientific information, but they are not easily accessible ; and the following observations therefore have been courteously intrusted to me for publication with the view of drawing attention to the subject, and also of showing how the matter stands in our country without being encumbered by confusion from differences of climate, breeds, and treatment involved in working on foreign observation.

Warble attack is commonly known as consisting of swollen lumps—few or many—to be found chiefly during the months of April and May on the back or loins of the attacked animals, each swelling or warble containing a maggot or “bot,” which lies with its black-tipped tail (often taken for its head) at a small opening in the swelling, and the other end (which contains the orifice which serves for a mouth) in a sore on which it is feeding in the under tissues of the hide.

The great injury, however, which is caused year after year by this attack is not only from the perforations of the maggots lessening the

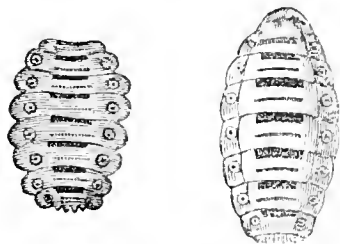
value of the hides, but the loss in flesh and milk and health in summer, when the animals are started by their terror of the Fly to gallop as fast as they can go, and later on the suffering and drag on the system of supporting may be six, ten, or twenty, sometimes even more than a hundred, of these strong maggots growing up to an inch in length and feeding in the sore, which they keep up from January or February until they are full-grown.

We do not know with certainty whether the losses taken together amount, as estimated by Mr. Stratton, of The Duffryn, Newport, to a yearly sum exceeding *one million pounds sterling*, or the higher estimate of Mr. W. H. Liddell, of upwards of *two million pounds sterling* a year to Great Britain and Ireland; but it is demonstrable that the loss is very heavy, the suffering to the animals often very great, and it is equally certain that the attack might *be very greatly lessened, safely, cheaply, and without injury to the hide.*

The following notes will be found to be chiefly of methods of treatment found to answer, and of habits of the pest observed for practical service by known agriculturists and cattle owners, with additions regarding the condition of the maggot in the hide, and details of injuries to the leather, for which, together with specimens liberally supplied, I beg to offer my best thanks to all the contributors.

The subject is perhaps best begun at the stage at which it is most observed, by observations of methods by which *the maggot may be surely and easily killed in the warble*, followed by notes of *absence of attack where this course has been followed for years*; likewise some observations as to the *damage* to the health of the cattle from *inflammation and ulceration of the subcutaneous tissues*; of the prevalence of the attack on special ages and breeds of cattle, and notes showing that the warble with the maggot in it, though most prevalent in April and May, is to be found occasionally much later in the year.

Various applications and methods of treatment whereby the maggot may be killed in the warble.—(It should be observed



Maggots of Ox Warble Fly, full-grown, and about to change to chrysalis.

relatively to destroying the maggot that it breathes or rather draws in the air necessary for it through the two somewhat kidney-shaped black spots, which are easily seen in the tip of the tail-end of the maggot in an advanced warble. If these “spiracles” or breathing-pores are choked the insect dies; consequently, if anything like tar or mercurial ointment, or other choking substance,

is applied, the maggot is sure to be destroyed).

Piercing the warble is not so perfectly certain to kill it, as the operation is not always thoroughly performed. Of the various

applications noticed that of mercurial ointment appears the simplest and surest.

The first communication is from Mr. Stratton, of The Duffryn :—April 11th. “I have treated some warbles with acetic acid, some with tar, and some with *mercurial ointment*; I have not the slightest doubt but that all will be effectual. I am satisfied there will be no difficulty in killing the grub with any one of fifty simple remedies.”—

About a week later Mr. Stratton added :—“I treated others with *mercurial ointment* (such as is used for scab in sheep); the effect of this is very remarkable, for in a couple of days after the application the grub appears to be quite decomposed; and I am persuaded that no remedy can be more safe, simple, and effectual than this. It would not cost twopence a head to treat all the cattle in the country in this way.

“It is quite easy to destroy the grub by a stab, but the cattle object to it; it appears to hurt them almost as much as a puncture through the skin. The objection to the scalpel, &c., is that when you treat an animal for this attack all the grubs are not in the same stage, and some have no orifice developed, or only a small one, through which it would be difficult to make an insertion; whereas, whether visible or not, a little of the ointment rubbed in would destroy the grub effectually.

“Tar had the desired effect in every case but one, and in that I think the hair kept it from the opening. Acetic acid was perfectly effective.”—R. STRATTON, The Duffryn, Newport, Mon.

“I beg to state that I find the *yellow mercurial ointment*, *Ung. Hydrag. Nitratis*, will destroy the maggot of the Bot Fly when in the hide of the animal. It must be rubbed in slightly.”—JOSEPH ADDISON, Mapledurwell, Basingstoke.

“In America it has been found that a little *mercurial ointment* applied to the swellings in autumn acts very well in killing the young *Hypoderma* larva, but the simpler and equally effectual way is to rub the back and sides, and especially the back, with pure kerosine oil.”—Prof. C. V. RILEY, Consulting Entomologist, Department of Agriculture, Washington, U.S.A.

“The smallest quantity of *mercurial ointment* (as much as a small pea) placed on the hole in the skin carries death within twenty-four hours. After applying the ointment to about forty-five cows, I cannot tell exactly the numbers that were in the cows’ backs, but my impression is that there were seldom more than six in one beast.”—E. E. McBRIDE, Glendonagh, Middleton, Co. Cork.

May 4th. “The larvæ or bots of the Ox Bot Fly are now approaching maturity, and cutting their way through the hide of the animal, and forming the injury that fellmongers call ‘warbles.’ A

needle into every one carefully occasions not the least pain whatever to the animal, but by piercing through the body of the insect destroys it.

“ I have often rid an animal of them, but only when tied ; loose animals entail the trouble of securing them, and so on.”—D. TURVILL, West Workldham, Alton, Hants.

Effect of removal or non-removal of Warble maggots on subsequent amount of Warble Fly attack.

The two following notes draw attention to the important point that, though warbles are often brought in on bought cattle, yet that the grub can be surely and certainly destroyed ; and Mr. Milne's note shows the good effect of continuous attention. This is confirmed by Mr. Stratton's observation regarding absence of fly-attack after previous removal, and by the note of Prof. P. McConnell of the presence of attack where the grubs were not destroyed.

“ Regarding the Ox Bot Fly, I may say that I have had none on my farm for at least ten years. My cattle are now never seen, with tails erected, running as fast as their feet can carry them. Purchased animals generally have these warbles in their backs ; these we take good care to take out by making a small opening with a penknife and pressing out the worms. Thus we do not have the Bot Fly, neither does it seem to come from other farms.”—JOHN MILNE, Mains of Laithers, Turriff, Aberdeenshire.

“ I always notice that bought cattle, and especially those from Wales and the West Country, are more affected with warbles than our own. I am strongly of opinion that the best way of killing the grub is to rub some unguent on the surface of the lump-hole in spring. An old friend of mine always used McDougall's sheep-dip preparation for this purpose with good effect. This method, of course, leaves the hide injured by holes. If there is any chance, however, of exterminating the Fly, it is a feasible and right method.”—Prof. H. J. LITTLE, Coldham Hall, Wisbeach.

June 25th. “ My cattle away on the level are now being tormented beyond endurance ; these were not treated for warble, because I knew that they would be surrounded by others that would be full of warbles ; but here, where I had all the warbles destroyed, I have observed only one animal running from Fly, so far, though in other years they have suffered badly enough. This looks like the effect of treatment, and, if so, indicates that the Fly does not go far from its birth-place.” — R. STRATTON, The Duffryn, Newport.

“ Unfortunately I have never given the subject much attention ; not that I have not had an opportunity, for out of sixty cows I should say that the larger half were infested, but simply that we take the

thing as a matter of course, allow the grubs to 'ripen' and fall out of themselves, when the skin heals up again. Now that you have called my attention to the subject, however, I will study it."—Professor McCONNELL, Ongar Park Hall, Ongar, Essex.

The following observations mainly refer to the amount of warble attack being influenced by the age, health, and method of treatment of the animal.—The first two notes draw attention also to the important point of the great suffering caused by the warbles, as shown by the ulceration and inflammation found within the hide, and the feverish state of the animal.

It will be observed that for the most part the attack is considered worst on young cattle, but it is by no means limited to these; and I have added (p. 106) a portion of a letter written by Mr. W. H. Liddell to the Editor of the 'Leather Trades' Circular' in 1878, as it gives the thread of connection to the previous notes, showing that exposure without possibility of shelter, weakness, and neglect are all *favourable to increase* of warble attack, whether in old cattle or young.

A few further notes of the use of mercurial ointment or of pricking the maggot are also given.

"I suffer very little from warbles on my own cattle, and I think it is owing to their being kept well; but those I buy in the spring are usually in a fearful state, *both from warble and from low condition*, and I have had them quite ill from the effects of these pests. I then find nothing like a good cooling drench, as they almost run to fever point."—E. R. BERRY TORR, Westleigh House, Bideford, Devon.

"In the spring, when cattle are in the house, if the hand is pressed along the back, any warble can be easily detected, and might, I think, be as easily destroyed. A needle or sharp instrument (dipped in some acid or poison, if necessary) would be certain and effectual. If some such plan could be generally adopted, how soon *the flies would be thinned*, and their progeny prevented from preying upon future generations of cattle.

"The agony these poor creatures must endure when these great worms are feeding upon them must be terrible; doubtless numbers every year perish in consequence. I have many times in the spring of the year noticed hides taken from say two-year-old bullocks which have died, and have seen how the back has been *one mass of sores, the discoloured blood and matter* showing how intense *has been the inflammation*.

"The warble grub, as you will be aware, is enclosed in a cyst of cellular tissue, and I imagine it lives upon the pus or secretion which is set up by its presence. The tissues immediately below the hide are very vascular and very sensitive; the hide itself does not appear to be penetrated by blood-vessels, at least by none visible to the naked eye.

The worm must therefore have excellent feeding ground, and it lives and thrives, taxing doubtless the strength of the animal upon which it preys, but not in the majority of cases destroying its life. Cattle at the age of one or two years are most subject to attack.”—JOHN DALTON, Wigton, Cumberland.

“Young (yearling and two-year-old) beasts are most subject to attack [of warbles], and shorthorns more so than the thicker-skinned Welsh or Scotch breeds; the hide of a Welsh ‘runt’ is quite twice as thick as that of a shorthorn bullock.”—E. A. FITCH, Brick House, Maldon, Essex.

“This year (1883) seems to be an exceptional one as regards these flies, as I cannot remember another in which so few have been about, and for so short a time.

“My reasons for thinking that dirty farming contributes to the evil are these: I find almost every bull-hide warbled, and nearly all cows—particularly old cows—which, *judging by the hide, have been badly fed and kept*, and the young oxen and heifers, which have a *better keep* and better *groomed* appearance, are almost all free, or nearly so, from warbles at all times. I notice that nearly all kips (that is, hides off yearling cattle) that have died a *natural* death are covered with warbles. Are deaths of these almost calves to be attributed to the fact that the irritation they cause exhausts nature?”—H. C. HAINES, Newport, Mon.

Extract from Letter to Editor of ‘Leather Trades’ Circular and Review,’ May 8th, 1878.—“Some say they find them [warbles] worst in poor cattle; others again entertain the absurd idea that cattle are in the best healthy condition when they have warbles. They are worst upon young cattle, if they strike, as they often do, when they are stirks six or eight months old. The infliction takes greater effect upon a young growing animal than upon one that is older and fuller in condition.

“And *why are bulls* so very subject to them? Because they are often fastened, and have no means of clearing themselves of the Fly when grazing, and in winter tied up without any attention paid to the state of their backs.”—W. H. LIDDELL, Leather Market, Bermondsey, London, May 7th, 1878.

(The following observation regards amount of development of warbles varying in cattle which have been differently treated *after* being to all appearance exposed first to exactly the same amount of attack. This point and the cause is worth investigation.—ED.)

“Take half of a number of bullocks that have grazed together through the summer, and tie them in stalls in October or November for fattening, and leave the other half out in an open yard as stores, and you will find in January and February that not a single bot is to

be found in the stalled animals, whilst not one animal in the other lot is free from them.”—D. TURVILL, West Worldham, Alton, Hants.

The following notes carry on the observations from the main time of the attack, to the maggots “leaving the cattle fast” in May up to the hides observed being almost free in July, and the last observation of maggots extracted from the warble on August 2nd.

May 15th. “I examined a byre yesterday near the sea, and failed



Chrysalis of Ox Warble Fly, side view, and showing contained Fly.

to find a single warble. Next place I went to the cattle's backs, which were nearly covered. *The grubs are leaving the animals very fast now in this district.** As soon as the larva escapes you can squeeze a quantity of

thin pus out of the cavity, and in some cases it is very thick and muco-purulent. On

examining the backs of several carcasses when the skin had been removed, I could not find

any marks to show where the warbles had been. Some of the fleshers told me that at times they penetrate the flesh and spoil the sirloin.”—H. THOMPSON, Aspatria.

July 9th, 1884. “At the present time hides are almost free from warbles, the worm having in almost every instance escaped. The last three weeks is the period (this year and in this part of the country) when the creature has made its exit. In two or three weeks after the escape of the worm the hole quite closes up, and the only trace remaining is the cicatrix where the wound has been. In some of the pieces of leather sent you might notice both holes and *marks*: the latter were the healed wounds of the previous year. A warble-hole, like any ordinary injury to the skin, though healed, can always be traced, and no matter how long the animal may live, the scar remains.”—JOHN DALTON, Wigton.

“We are not so much troubled with Ox Warble Fly as in previous years. Yesterday (July 22nd) I carefully inspected a herd of sixty cattle; only one showed symptoms of having had the warble; out of

* When the warble-maggot is full-fed it presses itself gradually out of the opening at the top of the warble, which at first sight looks much too small for the exit, but the opening can be squeezed somewhat larger, the soft maggot is compressible, and is further helped in dragging itself out by the ringed shape and roughened skin, which prevent its slipping back again into its former hole. When it has fallen to the ground it creeps to some shelter, under a stone, a clod, or where may be convenient, and there the skin hardens into a chrysalis coat much like the grub, excepting in being dark brown or blackish in colour, and somewhat flattened on one side. From these chrysalids the warble flies come out, in favourable weather, in about four weeks from the dropping of the maggot from the back of the cattle; in cold weather the time required for the change is longer. For details of above see ‘Essay on Bots,’ by Bracy Clark; ‘Monographie der Cestriden,’ by Friedrich Brauer, and other writers.

six, four had left matter exuding from the wounds.”--RALPH LOWE, Sleaford, Lincolnshire.

“I send you three warble grubs taken from the backs of dairy cows after a slight application of mercurial ointment to the holes in the skin. The date of extraction was the 2nd of August.”--E. E. McBRIDE, Glendonagh, Middleton, Co. Cork.

Loss on Warbled Hides.

Up to this point the observations have mainly referred to the stage of attack in which the maggot is injurious to the hide, and the particulars on the annexed table, with which I have been favoured by the courtesy of Messrs. Fry and Company, Leather and Hide Factors, Moor Street, Birmingham, show the great money loss caused by even this one part of the effects of warble attack.

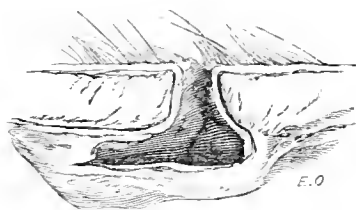
Particulars of seven weeks' supply of six classes of hides, being the total of each class of sound and warbled sold at two markets in Birmingham, commencing May 3rd up to and including June 14th, 1884, and showing the actual loss of each class of warbled hide:—

Six Classes of Hides.	Hides.		Sold at	Per hide less than the sound.	Loss on each Class.		
	No. of sound.	No. of warbled.			£	s.	d.
Weight from							
95 lbs. and upwards	286	67	$\frac{3}{4}$ d. per lb. or	6s. 3d. per hide	20	18	0
85 lbs. to 94 lbs.....	446	222	$\frac{7}{8}$ d. „ „	6s. 7d. „	73	1	6
75 „ 84 „ 754	754	373	1d. „ „	6s. 8d. „	124	6	8
65 „ 74 „ 881	881	579	1d. „ „	5s. 10d. „	168	17	6
56 „ 64 „ 629	629	441	1d. „ „	5s. 0d. „	110	5	0
55 lbs. and under ... 283	283	224	1d. „ „	4s. 3d. „	47	12	0
Totals.....	3279	1906		Total.....	545	0	8

It will be observed that of the total number of hides (*viz.*, 5185) over one-third were warbled ; and, looking merely at one line of the figures, it shows that out of 1460 hides, ranging from 65 lbs. to 74 lbs. weight, 579 were lessened in value at the rate of 1d. per pound, or 5s. 10d. per hide, giving a total loss on these of £168 17s. 6d.

The above table of particulars does not include the three classes known as “ heavy ” and “ light ” cows’ and bulls’ hides, which also were warbled, but the numbers of which were not taken, on account of Messrs. Fry not being as much interested in these as in the other classes. Enough, however, is noted to supply a scale which, if applied to the returns of the other hide markets, would give a fair idea of the extent of what is in truth the *enormous waste* which is going forward, as there is not the slightest necessity for warble attack being permitted to run on unchecked. Further, this depreciation in the value of these hides is unmistakable evidence of there having been

presence of *inflammation, and of maggot-sucked sores* running an inch or more in the under tissues of the hide, causing a loss in the benefit of food and health (with further details I need not enter on here), and a *course of suffering* to the animal which certainly calls for the general attention which many of our leading cattle owners and farmers ask for.



Section of Warble, slightly larger than life.

In reply to enquiries regarding damage from Warble Fly and amount of hides injured, Mr. C. Haines favoured me with the following observations and approximate estimate:—"I seldom see much of the warble in the pelts, excepting during March, April, and May; so it would seem, in the early stage of its propagation, that it would not materially affect the hide, however much it might injure the health of the beast which afforded it a temporary shelter.

"The following information must be taken as the result of my observation here; the effects would probably vary considerably in different parts of the country, as I should say *temperature* and *cleanliness* in farming would have much to do with it.

"I usually commence to notice them as April comes in; for about a month I should judge 50 per cent. to be damaged, for the next two weeks say 20 per cent., and for one month additional say 10 per cent.; allowing thus liberally should about cover the year's damage."—H. C. HAINES, Newport.

Notes of amount of injury to imported Hides.

I am indebted to the courtesy of the Colonial Company for favouring me with the following reply to my inquiry as to attack on imported hides. On the 8th of August Mr. B. Brown, Secretary, wrote me:—

"I enclose copy of reply I have just received from an experienced firm of hide and skin brokers to an inquiry we made of them as to the injury done to hides, &c., by the Warble Fly."—B. BROWN, Sec.

"Reply to the inquiry of the Colonial Company respecting the damage done to hides and skins by the Warble Fly:—

"Parcels of ox and cow hides and goat and sheep skins coming from all parts of the world, all contain a varying proportion of warbled hides and skins, the damage, as a rule, being greatest on those from the hottest climates, and generally affecting goat skins to the greatest extent.

"Those hides and skins coming from Mogador and other northern parts of Africa suffer most in this respect, an average perhaps of about one-fourth of them being damaged to the extent of 60 or 70 per cent. Those from Kurrachee also suffer damage to almost the same extent,

while those from Calcutta, Madras, and Bombay are depreciated perhaps to the extent of 50 per cent. on 10 per cent. of the skins.

“ ‘From Cape Colonies the damage is comparatively slight, and still less in those hides and skins from Australia and South America.’ ”—Communicated by Sec. of Colonial Co., Leadenhall Street, London.

The following note, from personal observations by Mr. D. Byrd, gives *approximate estimates of loss of value on growth of feeding cattle* from disturbance, and on *weight of cheese and percentage of milk* calculably lessened by the same cause:—

“ We all know to our cost how greatly these tormenting flies irritate and madden the cattle, causing them to gallop or run, as if for their lives, to get away from the buzz and presence of their tormentors. Feeding cattle cannot grow in flesh without quiet and rest, and milking cows must suffer to a greater extent than we are aware of. To use a common remark, they soon ‘bate’—give less milk. To drive a cow fast, or cause her to be excited, reduces the quantity and quality of the milk. Without perfect quiet and rest they cannot do their best for us.

“ This leads me to the one important point. What is our loss in the cheese-tub caused by the Warble and Gad Fly? I have tried to estimate the loss during the four or five summer months, or even the eight months that a cow is supposed to be in profit. There are certain times of unrest when the cow will give about one-half of her usual flow of milk. These tormenting flies, and the continued presence of the prickly-coated warble maggot, must keep up a perpetual uneasiness, and retard the growth of our feeding cattle to our loss, it may be, of £2 per head. In the dairy cows the loss will be greater. The daily loss of milk may make a difference of 1 cwt. or $\frac{3}{4}$ cwt. of cheese per cow per annum. Half a hundredweight, or $12\frac{1}{2}$ per cent., of milk less in a dairy making 4 cwt. at 70s., comes to 35s.; but $12\frac{1}{2}$ per cent. is too low an estimate: it may in some cases be put at £3 per head, and in a dairy of 100 cows would show a loss of £300.”*—D. BYRD, Spurstow Hall, Tarporley, Cheshire.

* The above note also formed part of a paper communicated by Mr. Byrd to the ‘Chester Chronicle’ of Feb. 7th, 1884. Mr. Byrd’s mention of “the Warble and Gad Fly” is very important, as these two very different attacks are often confused. The Gad Fly, *Tabanus bovinus*, is much larger than the Warble Fly, and injures the animals by driving its sucking apparatus into them very painfully and drawing away the blood, and also, like the Warble Fly, by terrifying them into the wild gallops we know so well. From some of the subsequent observations given on p. 113 it appears that the applications noted as useful to keep off one sort of Fly are equally useful to keep off the other; and this point of the cattle so dressed being able to feed in peace whilst the others were being hurried in all directions is well worth consideration.

Summer attack.

About four weeks after the maggots have been noticed leaving the backs of the cattle the summer attack from Warble Fly may be expected to begin, and to be great or small in amount according to the number of maggots which were allowed to live.

The Warble Flies are about half an inch long, striped or banded with different coloured hairs so as to look not very unlike light-made Humble Bees. They have larger heads, with yellowish faces, the body between the wings yellowish before and black behind, and the abdomen banded successively with white, black and orange, the orange being at the tip. The two wings are brown, *without spots*, the legs black, with pitchy or red feet.*

The egg is stated to be white and oval, with a small brown lump-like appendage at one end. How the animal is "struck"—that is, how the egg is attached to it—is not yet proved. (For references regarding this point, see Index).

The following observations note the date of attack as being chiefly in July and August :—

"The period they [the Warble Flies] annoy the Ox and deposit the eggs in this climate is from the middle of July to the middle of August."—JOHN MILNE, Mains of Laithers, Turriff, Aberdeenshire.

"In this part the perfect insect generally deposits its eggs about lea-hay time, July and August, and from the way the cattle (young ones two and three years old particularly) gallop through the pastures with tail erect, I am inclined to think that the ovipositor pierces the skin, and the egg is deposited within the skin. Nothing seems to be seen till March, when the little swellings are observed on the cows' backs, and during April and May the larvæ leave their winter-quarters and fall to the ground."—HENRY THOMPSON, Aspatria, Cumberland.

. "It appears that the Fly during the summer deposits its egg in the skin on the back of the ox, and during winter several little lumps make their appearance on the animal's back, and about April and May a little hole is observable in each little lump; and I have at this time squeezed a great many of the bots through the holes."—J. B. SCOTT, Sutterton Grange, Spalding.

August 8th. "Cattle are suffering very much at this time from the Fly. Fancy a fat beast having to run perhaps ten miles a day in

* For details see authorities cited at the end of this paper. It may assist those who wish to secure specimens of the Fly to mention that the best method appears to be to fasten a small stout gauze or muslin bag by means of a ring of tar on the infested animal just when the warble is what is termed ripe. The maggot will drop uninjured into the bag, and, if lightly covered with earth in a wide-mouthed bottle with a gauze over the top (or, better still, covered with earth *out of doors*, and an old gauze dish-cover set over it), the Fly will most likely, in due season, be secured. This species is very difficult to procure from entomological dealers.

this heat! Many lose £1 worth of beef in a week from this cause. —R. STRATTON, The Duffryn, Newport, Mon.

. "In the hot summer days our cows are tormented by the Fly, and we frequently see them galloping with tails up to get out of the way of their tormentor; this lessens the quantity of milk, and prevents feeding cattle growing." — D. BYRD, Spurstow Hall, Tarporley.

In the following notes of applications or treatment of the animals, which have been found to *prevent* attack, it will be seen that there are a few special points acted on. These are—*1st, applying mixtures of such a strong smell as may be obnoxious to the Fly and overpower the attraction of the smell of the animal; 2nd, applications which would stick the Fly fast or kill the egg; 3rd, washes which would clear off the eggs or destroy them if laid on the skin, or if lying just beneath the outer cuticle; 4th, protection afforded to cattle by being housed at egg-laying time.*

"Respecting the application of anything to prevent the Warble Fly depositing the eggs, there are a number of matters of a tarry nature that might be applied, and nothing better than Stockholm or green tar itself rubbed along the cows' backs before turning them out, which would last all the summer season, or applied in May or June between the top of the shoulder-blade and loins. This is the only part the cow cannot lick, rub, or lash with the tail; hence the only *peaceable* place where the Fly can leave its egg. Or sheep-salve (bad butter and tar mixed with sulphur). About two applications would last a full season. Or the application of brine and the mixture I have already given you. Paraffin, kerosine, carbolic acid, phenyle, &c., are all too transient to be of much service, and would have to be applied frequently." — H. THOMPSON, M.R.C.V.S., Aspatria.

Mr. Thompson further notes that he has been told it was a common practice to wash the cows' backs with pickling brine, the application being used two or three times during the season. In this part large farmers keep what is called the pickling-tub, wherein they put beef and mutton; the brine is made with salt and water, salt being added till an egg will float. This is an old remedy, and I think a good one, as I think the ova would be destroyed immediately it was placed in the skin.

"I have used and also recommend the following mixtures as a preventive:—Flour of sulphur, 4 oz.; spirits of tar, 1 gill; train (whale) oil, 1 quart. Mix well together, and apply along the spine of the cow once a week with a small brush. The smell drives off the flies, and prevents them depositing their eggs, and the cattle are left *at peace* to graze, and warbles thus prevented." — HENRY THOMPSON, Aspatria.

"I venture to give my experience of many years. If cattle that

are turned out into the fields (those that are in sheds escape entirely with me) are rubbed all down the spine with train oil, and a little also on the loins and ribs, they will be free from this pest, have their hides uninjured, will do much better, and will graze quietly at the time that others not so treated are tearing about with their tails in the air.

“Two or three dressings I generally find enough, but much depends on the season and the thickness of the ‘coat.’”—B. ST. JOHN ACKERS, Prinknash Park, Painswick.

The following observations, received on Feb. 25th, confirm the use of the mixtures of the nature of those above noted, by absence of attack being *now* found to be following their application, whilst other cattle at the same place are showing warbles :—

Feb. 23rd. “Last summer we had twenty-eight two year-old heifers on an outlying field: they showed symptoms of ringworm got from neighbouring stock. I took the twenty-eight into a house and applied the following wash to them, rubbing the entire back once :—Spirit of tar, carbolic acid, sulphur, and linseed oil (I am now sorry I did not measure the proportions of the mixture, but I merely made it sufficiently strong to counteract the ringworm).

“The result is, I have not one case of warbles amongst the twenty-eight heifers. I have it on others, and used to have lots of it on the two-year-olds. As I believe the spirits of tar, carbolic acid, and oil kept the warbles off, I shall try it again. Meantime, I should like, if others would try it as well as myself, to test it thoroughly.”—D. SYM SCOTT, Ballinacourte, Tipperary.

In the first line of this page is an observation as to cattle which are *always* in sheds at egg-laying time escaping attack. It would be very useful to have more information as to the condition of cattle which had access at will to the shelter of sheds in the heat of the day.

At Sedbury Park, in Gloucestershire, where I have seen our cows in exposed pastures going at the swinging trot that shows fly-attack, I never saw this in one field where there was a thick open grove of oaks with a shed beneath it, within and round which the herd sheltered themselves and picked the hay that might be strewn about.—ED.

The following note refers to this point, and likewise to *housing at night*, which has not been brought forward before, and may prove important relatively to some of the *Estridæ* being exceedingly lively in the bright moonlight :—

“I seldom get any warbles in my own young cattle, and I think from this cause,—that *they have sheds to run under during the summer, and are housed at night*, and have a good feed of cake; and my belief is that flies of any sort always prefer *working* on poor half-starved things to well-fed ones.”—E. R. BERRY TORR, Westleigh House, Bideford.

The following notes confirm the opinion (brought forward, I believe, first by Bracy Clark, and held by many writers) *that the Warble Fly does not follow the cattle over water, consequently that allowing access to shallow pools is a great preservation from attack*:—

June 28th. “During the recent hot weather I have frequently seen my feeding bullocks suddenly gallop off, with their tails erect, and rush into the nearest water, where they seem to be less tormented by the flies.”—J. B. SCOTT, Sutterton Grange, near Spalding.

“The amount of warbles on an animal and amount of warbled animals in a herd will be rather difficult to arrive at, but I would say from fifteen to twenty warbles on the back of each animal,—that is, grazing on lands well sheltered with trees; but where there are *good large ponds, and the animals go into the water and stand during the hottest part of the day, they are not so rife*. From what I can gather, as well as from observation, I find the Warble Fly will not cross any extent of water.”—H. THOMPSON, Aspatria, Cumberland.

“Our cattle do not suffer much, but then we have plenty of marshy ground close at hand, and a good deal of timber which affords shade.”—Prof. W. FREAM, College of Agriculture, Downton.

The main points of the preceding observations taken in order show the following results:—1st. That when the warble is seen in what is its common condition in April and May, the maggot within can be killed (by various applications specified) both surely, easily, and without injury to the health or hide of the animal or much outlay to the owner.

2nd. That where this plan has been adopted there is found to be absence, or very slight presence of, warble-attack; and on the other hand, where warble grubs have not been destroyed, the cattle have been found to be attacked as a regular thing.

3rd. With regard to Fly-attack in summer, notes are given of applications whereby the cattle have been preserved from injury and from the terror of the Fly; likewise notes are given of the use of shelter during the time of Fly-attack, and also of the serviceableness of access to shallow water as a protection from the pest.

4th. It appears certain that in this country the open warble is not generally seen until at least some way on in the month of February.

Other points of interest are given, especially some reliable details and estimates of loss, which well deserve consideration; but besides the above notes we need to know more from observations of the live maggot, as to its method of growth, and the manner in which this causes the warble. A few specimens of exceptionally early appearance of the maggot swelling *beneath* the hide, and also of perforated swelling showing *outside*, were forwarded me, from which I give the following notes, which it is purposed to complete as the coming season may give

opportunity, and to publish with all the details, illustrated by figures from the specimens.

First observation of young Warble beneath the flesh side of the Hide.

On Nov. 12th of last year a cutting from a yearling skin brought in that day was forwarded to me by Messrs. C. and H. Hatton, Barton Tannery, Hereford, with the note that they considered it showed first symptoms of warble maggot. This piece of hide was about 12 in. by 4 in., and on the *flesh side* there were upwards of seven slight swellings about a quarter of an inch across, of a livid or bluish colour, each forming a raised centre to greatly-inflamed patches. Within the blue centre I found a small warble maggot, just large enough to be distinguished by the naked eye when removed, but not plainly so whilst in the swelling, as the inside of this was of blood-red tissue, and *the small maggot was blood-red also*. Under the microscope it was easily distinguishable by its patches of minute prickles, but I was not able to remove one specimen quite entire. From the red mass or maggot-cell I found that a fine channel passed up through the hide to the surface. The course of this channel was easily traced by the blood which in handling the specimen was pressed from below along this gallery till it came out in a little drop on the outside of the hide. This passage of blood or matter appeared to have been going on previously in the natural course of things, for I found some specks of dried matter on the outside of the hide. It is important to observe that these channels varied in direction,—one was straight through the hide, another slanting, and another went up *nearly* to the outer part of the hide and there *turned* and went a little way just under the cuticle, and ended in a small cavity just below the surface.*

From the presence of these *small cavities just below the cuticle*, and

* It is a curious coincidence that just about the time when the first appearance of the live maggot was observed, as noted above, information from at least three localities was sent in of small lumps or warbles being produced so far that they could be felt on the backs of cattle, but which did not advance further in growth. Whether these were warble swellings, or were abortive warbles,—that is, swellings beneath the hide in which, from some cause unknown, possibly from unseasonable development, the maggot had died,—I cannot be certain, as being on living cattle examination was impossible. On one hand, some of the first observations of open warble in spring were taken from these cattle; on the other, a good many specimens of small swellings or tumour-like lumps formed on the flesh-side of removed hides were also sent me, which might be the cause of outside lumps. These contained maggots so completely and tightly grown up in the tissues that there was no communication with the hide. The maggots were of various ages up to approximately a quarter grown, and had obviously been long dead from the perished state of the internal organs; and it would be of considerable interest to know whether the death of these maggots was from unseasonable development or from some cause we could follow up serviceably.

the fine canal running downwards from them or from the surface, as the case may be, to the young warble cell beneath the hide, I think we shall find the egg is fixed just *beneath the cuticle*, and that *the young maggot* works its way through the hide to where we find it in its early stage. It does not seem to me *possible that the Fly could pass the egg* through the hide by means of her egg-laying apparatus (or ovipositor), because, as observed, the passage down to the maggot-cell is sometimes of a shape that *could not* have been caused by the ovipositor.

This matter is by no means of mere scientific interest, for the fact of the egg lying just below the uppermost film of skin (or cuticle), and the maggot leaving an open channel behind it, whereby poisonous washings or dressings will reach it, or may choke up its breathing apparatus, is very important practically.

In the earliest stage in which I have as yet had specimens of the maggot I found the openings of the breathing apparatus varied from the adult form.

First observation of open Warble swelling.

The first note of appearance of the open warble was sent to me on Jan. 27th of this year from Wigton, Cumberland, by Mr. John Dalton, to whom I have especially to offer my thanks for his continuous observations from the end of August in 1884, which have clearly shown the serviceable fact that up to the date above given the warble was not noticeable, for practical purposes, in open condition.

On Jan. 27th Mr. Dalton wrote:—"I have to-day noticed, for the first time this season, the appearance of the young warbles. I found them in two different hides, both off young cattle of from one to two years old. . . . *The round hole in the hide is distinctly visible.*"—JOHN DALTON, Wigton, Cumberland.

The first general observation of the appearance of the warble as a swelling, or in open condition, began at the middle of February. On Feb. 14th Mr. E. E. McBride wrote from Glendonagh, Midleton, Co. Cork, that "the lumps were increasing in number and size on his cattle"; and on the same day Mr. Byrd, Spurstow Hall, Tarporley, Cheshire, after examination of the swellings on the cattle, mentioned that "some appeared to be soft lumps resembling a soft gathering coming to a head."

On Feb. 18th Messrs. Hatton, of Hereford, mentioned that they had received an ox-hide with many warbles in it, specimens of the maggots from which were forwarded;* and on the previous day they had informed me that notice had already been given that hides on Birmingham Market would be sorted for warbles, and those having more than three would be out-classed.

* The cost of this hide was 29s., whereas the value of the same weight of hide free from warbles would have been 35s. 5d.

On the 20th I had the satisfaction of being able to examine the warble myself, in young open condition, in the hide of a Hereford which had been removed from the animal that day near Isleworth.

On Feb. 23rd (as referred to at p. 113), Mr. D. Sym Scott reported from Ballinacourte, Tipperary, that the warble had appeared on some of the cattle (though not on the twenty-eight which had been dressed).

On Feb. 24th Mr. H. Thompson, M.R.C.V.S., Aspatria, Cumberland, reported that he had found several small enlargements on young cattle, but no external opening; likewise that some of the boys of the School of Agriculture had that day found several enlargements on the backs of young cattle at the farm; and another reported small lumps on his father's cattle with black spots in the centre, covered with a gummy matter.*

On the following day Mr. Thompson reported that he had examined a large number of young cattle rising two years old, and found them well covered with the warbles in various stages; "some of them have twenty enlargements on the back, all showing the external opening."

Mr. Thompson favoured me, at the same time, with specimens of maggots, which show some important points which I believe have not been hitherto brought forward.

The warble maggot, when full-fed, and for much of its previous life, is well known to be of a bluntly oval, somewhat compressed, shape, of various shades of colour, from whitish to deep grey, and marked with cross-bands, which, under a magnifier, are seen to be formed of minute prickles. The maggots (as far as I am aware) in this condition have always an opaque skin. Earlier, however, in the condition in which they are observable by the naked eye at the time the warble is first opening, I find the form and texture of the maggot is very different.

The smallest which I have examined in this state was about a quarter of an inch long by a third of that width, not oval but straightish, or somewhat worm-like in shape; when older they became rather enlarged towards the mouth-end, so as to be of a long pear-shape, and in this condition, excepting dark cross-bands extending about a third round them, they were white and partially transparent. Whilst these small maggots were still apparently alive they were *hard*, and externally (over almost all their surface) of *glassy smoothness*. These conditions, joined to the peculiar shape and somewhat pointed

* I take pleasure in drawing attention to the above observation of the boys of the Aspatria School, as it shows the amount of intelligent interest and good serviceable observation which could be brought to bear on these subjects by our lads and young men throughout the country, if they were furnished with a *plain*, as well as a sound, foundation to work on.

ends, or end (according to age), adapted them most perfectly, in the first stage, for "travelling," in the second for pushing themselves up small end foremost, armed with the minute hard spiracles, through the opening warble.

As far as I see at present the changes of condition I have mentioned above are rapidly gone through, and, when the maggot has gained about a quarter or third of its growth, the spiracles are developed to an angularly kidney-shaped form, and the maggot assumes the compressed oval shape in which it is best known. It is still white, but opaque, and with the segments well-marked; *it has no occasion now to bore its way, and ceases to be furnished with a form fitted for perforation.*

On placing the very young maggots in water they swell so much as to become exceedingly rigid, and so transparent that much of the internal structure could be plainly seen.

By microscopic investigation the spiracles—that is, the blackish kidney-shaped spots which are seen at the tip of the maggot in the open warble—have two, and I think three, different successive forms before developing to the final and best known state; and they also differ from each other in the amount of spiracle exposed at the tip of the grub.

The breathing apparatus consists of a trachea, or breathing-tube from each of these spiracles or breathing-pores, and from each trachea a series of lesser and lesser tubes carries the air through the maggot. The two principal tracheæ are tied together near the spiracles by another short one, which forms a kind of bridge, or rather tunnel, of communication, and thus insures air supplies being continued if one spiracle should be choked. I also find that the young maggot possesses (apparently as an instrument for tearing out food) a pair of crescent-shaped forks or diggers. These are of such excessive minuteness that they are only to be found with difficulty, and I have not as yet found them in any but very young maggots. A fairly high magnifying power is needed for distinguishing their shapes; in my own case I have used a quarter-inch glass.

The difference in appearance, and especially in their *glass-smooth rigidity*, is so great between the young maggots when alive and fully inflated, and after death, when their flaccid condition conveys no idea of what their piercing powers have been, that I submit the above observations as being not merely of scientific curiosity, and hope to complete the investigation, and offer it in due time with illustrative figures. The above points seem to me to throw light on the probable method of *formation of the opening* of the warble through the hide. I do not find this passage (in great contrast to what is below) to be ulcerated or torn; it is merely a clean passage through the hide, smooth and shiny, as might be expected to be made by the pressure of

the growth of the smooth rigid maggot. In my investigations of yet earlier conditions I always found a minute channel from the outside of the hide to where the embryo maggot lay in the tissues beneath, and it appears to me that the enlargement of this passage by the young maggot forcing itself, small end foremost, up the ready-made tunnel, with its first spring growth, and, gradually enlarging the hole by the pressure of its own intensely hard, inflated, and rapidly enlarging condition, is the cause of the warble hole.

Disorganised tissue and ulcerated matter are sometimes dragged into the passage by the maggot, and in the opening of the warble we sometimes find a slight covering of gummy matter over the tip of the maggot, but the great mischief from inflammation, swelling, and disorganisation is beneath the hide.

The above refers to the first state of the passage of the *opening* warble. In a short time the maggot is to be found advanced to its oval form, and the passage through the hide to be then covered with a coating of some kind of skin, or lining membrane.

On the 3rd of March Messrs. Hatton further favoured me with a piece of heifer hide, less than six inches square, containing twelve or more warbles, which had now advanced in growth, so as to show on the flesh side of the hide as well-defined lumps, ranging from three- to five-eighths of an inch across, and up to as much three-eighths of an inch in height of the swelling.

All that I examined had openings on the upper side of the hide, and internally were now coated with a distinct formation of some kind of lining membrane, like thickened yellowish skin, continuous with the coat of the cell below. As I am not an anatomist, and the nature of this formation has been made the subject of minute German investigation and discussion, I merely mention its appearance, and refer to the figure, p. 109, drawn from a fully-developed cell last year.

Within the cells (in the hide above mentioned) the maggots now lay, still whitish, and hardly a quarter of their full size, but advanced to the compressed oval form, with broad and narrow bands of prickles, with kidney-shaped spiracles, and with the mouth end downwards in the ulcerated matter in which they were feeding.

This brings the investigation round to the point at which we started,—that of the maggot lying at our disposal in the open cell; for, whatever more we may find out, the great point of all that we are aiming at is *how to destroy the pest*; and I fully believe that as a beginning, if all who have cattle would have the warbles dressed with *mercurial ointment*, the benefit would be enormous.

I am greatly indebted to my contributors for the kind courtesy with which they have assisted this investigation, and, if they will be kind enough to continue their help for a few months longer, we might hope

to have the good results of stamping out warble attack whilst still in maggot-state clearly shown. The one point which as yet has not been observed is where the egg is laid, or rather how it is placed on or in the hide. This is not very important, but any observations bearing on prevention, or on points connected with this attack, will be gratefully received.

Those observers who may wish to study the minute scientific description of the *Æstridæ* will find excellent information in 'Monographie der *Æstriden*,' von Friedrich Brauer; descriptions, with serviceable life-histories, of the *Hypoderma bovis* are given in 'Praktische Insektenkunde,' von E. L. Taschenberg, part iv., pp. 84, 85; and the foundation of a large proportion of the information usually met with—that is sound, plain, and of practical use—is to be found in the 'Essay on Bots of Horses and other Animals,' by Bracy Clark, F.L.S., published in 1815. But our present research is putting the matter on such a practical and demonstrable footing from what we can all see in our own country, that I venture to submit to those who refer to me relatively to study of the subject that observations from life, both of the attack and of successful treatment, are of far more value than any quotation from already published books.

ELEANOR A. ORMEROD,

*Hon. Consulting Entomologist of the Royal
Agricultural Society of England.*

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1885.

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ERRATUM.

Page 86, line 26, for "Squills" read "Leeks."

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